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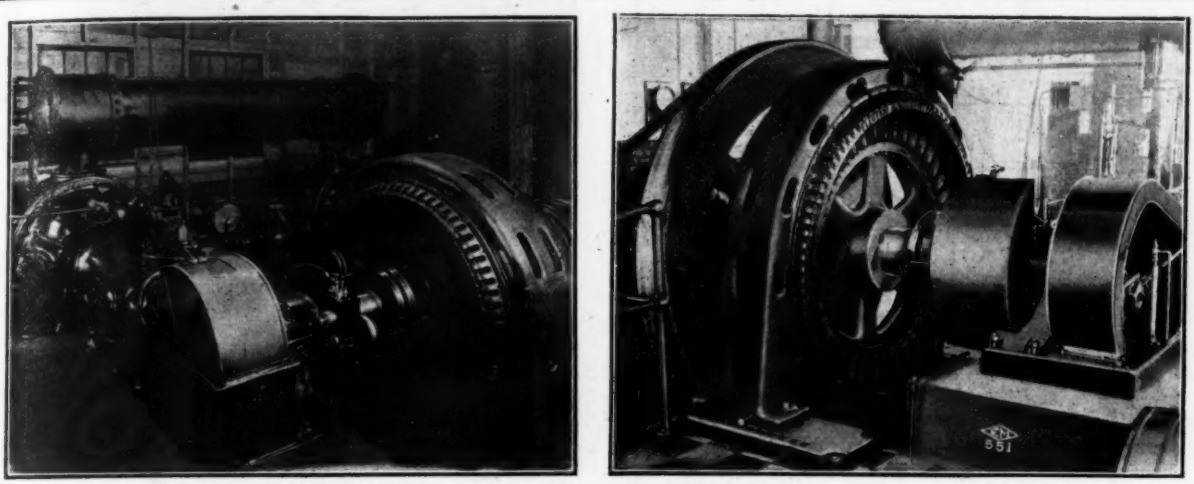


Two Synchronous Motors Operating on Central-Station Service.

Effect of Power-Factor on Central-Station Operation

Good Voltage Regulation and Transmission Efficiency Can be Obtained by Installing Synchronous Motors—Advantages to Customers Also Pronounced

By WILL BROWN

Manager Sales Service, Electric Machinery Company.

IT IS almost an axiom among central-station men that efficiency of electrical power generation and distribution depends to a large extent upon the power-factor of the system. Also the operation of the motors themselves may be considerably affected by conditions of low power-factor.

Every power user on a power system should be made to see that it is to his advantage to maintain as high a power-factor as possible. The question as to how far the individual consumer will go in the matter of installing synchronous apparatus can largely be settled by the central-station companies. Any method of economizing on his cost of power, providing the efficiency of his factory production is not impaired, will always appeal to the power customer.

This matter of power-factor improvement cannot be met in the future as it has been in the past, simply by the central station installing large synchronous condensers. It will become more and more desirable to have a connected load of many fair sized synchronous motors scattered over the systen . This is much better from the standpoint of voltage regulation, transmission efficiency, etc., than the old method of combining all the power-factor correction for the circuit in one or more synchronous condensers.

How Conditions of Bad Power-Factor Arise.

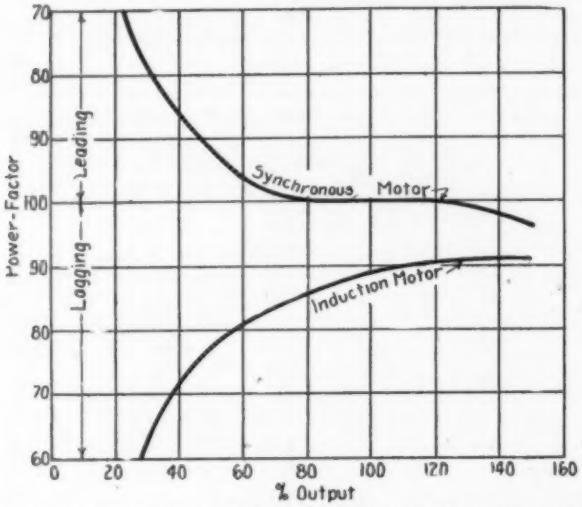
The power load of a central station is generally built up by degrees; and in the early stages the matter of power-factor does not cause trouble because the generators and the line are amply able to take care of a much larger load than they are called upon to handle. But as time goes on, and loads get heavier and the capacity of the generators and the distributing system begins to be taxed, the subject becomes of vital interest to central-station managers.

When this point is reached, the manager generally realizes that he is in difficulty. He has allowed conditions which breed poor power-factor to grow up upon his system. Many existing contracts cannot be disturbed, and the rate question is always a delicate matter. So the central-station manager is inclined to say, "Let's let sleeping dogs lie, and get along the best way we can, and if power-factor gets too bad, install synchronous condensers to take care of it."

As a matter of fact, many central-station managers

know very little about the average power-factor which their customers are maintaining.

The writer recently checked up information from one of the prominent power companies in the Middle West. There are quite a number of large power cus-



Curves Showing Power-Factor at Various Loads of Two 300-Horsepower Motors.

tomers on the line, such as flour mills, munition factories, pumping stations, etc. The company makes no specific regulation in its contracts as to power-factor, but the general superintendent stated that he was quite sure that the power-factor of most of these large loads was fairly good, probably 85 per cent or better. So we took tests on the load of one of the flour mills. These tests were made at different times of the day, 8 a. m., 10 a. m., and 12 midnight, so as to get all conditions of load. The load varied from 2950 to 3800 kilowatts. The power-factor ranged from 56 to 71.5 per cent lagging. It is probable that the average power-factor of this big load for the entire month was not better than 65 per cent lagging. And bear in mind, that this was a load of high load-factor running days, nights and Sundays. No one can afford to guess on this subject; every central-station manager should know what the average power-factor of his customers' load really is. This refers particularly to all loads of 300 kilowatt maximum demand or more.

Power-Factor Tests and How They Are Made.

Here seems to be the crux of the whole matter—there has never in the past been any accurate and simple way of keeping track of a customer's power-factor. Periodic tests at the customer's switchboard have been the method used by some companies. Tests are made at intervals varying from once a year to once a month; very seldom is a test made oftener than once a month.

Many companies admit that while they have a power-factor clause in their contract, they do not enforce it, due to the difficulties in metering.

Graphic Power-Factor Meters.

It is doubtless news to many that fairly satisfactory results are now being secured by use of curve-drawing power-factor meters. These are generally installed at customers' switchboards. The following description is given by a power company in New England using a graphic power-factor meter.

"The meter we use is a three-phase, 60-cycle, 110-volt, relay-type, graphic power-factor meter, with 110-volt, alternating-current, 60-cycle, control circuit, and costs us $164. This is a pretty high-priced instrument but seems to be the only thing which can be had.

"We do not figure that we can afford to install this on customers of less than 300-kilowatt load, but on customers of this size we believe it will readily pay for itself either in a saving it makes or in the higher rate which the customer pays.

"These meters so far have worked out very satisfactorily."

Bad Power-Factor and Its Evils.

The principal disadvantages of low power-factor to a central-station system may be roughly summed up as follows:

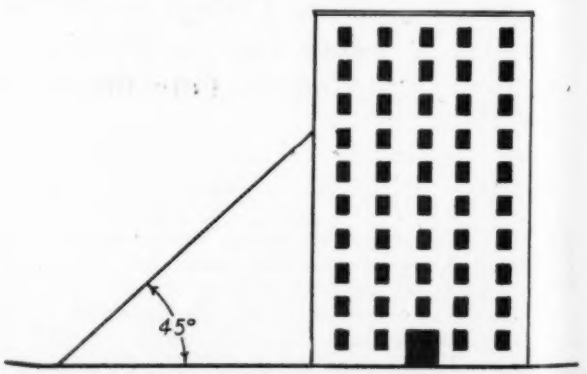
(1) Larger overhead costs of the generating, transmission and distributing system.

(2) Poor voltage regulation.

(3) Large I^2R losses and excessive heating of generators, transformers, etc.

(4) Inability to carry a productive load in proportion to the capacity of the system.

Let us take an ideal system operated fully loaded at 100 per cent power-factor; compare this system "A" with system "B" operating at 90 per cent power-factor, and system "C" at 70 per cent power-factor (all carrying the same load). Other things being equal, the cost of the system at 90 per cent power-factor would be about 11 per cent greater than system "A." The system at 70 per cent power-factor would be about 44 per cent greater in cost than system "A." But, as a matter of fact, these costs may actually be greater. For instance, take the matter of copper on transmission lines. A certain B. & S. gauge may be right for unity power-factor load, but the nearest correct size for a 70 per cent power-factor load of the same kilowatts may be considerably more than 44 per cent larger. In fact, there have been cases where the additional copper required for a load of 70 per cent



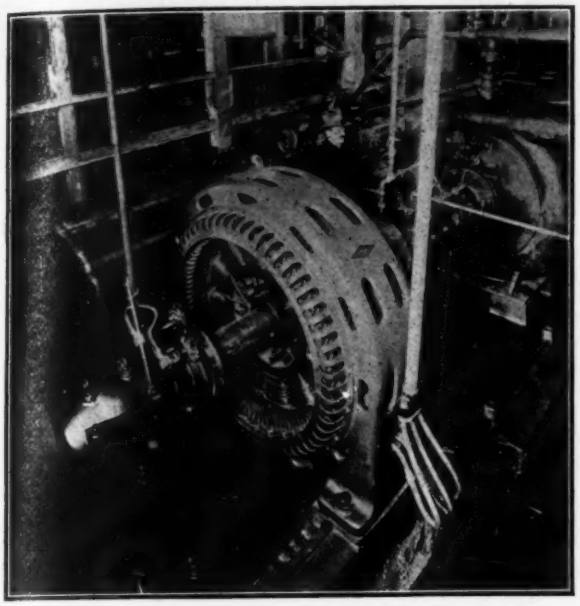
Represents a 10-Story Building. Ladder Now Reaches Seventh Floor. If Set Vertical Would Reach Tenth Floor.

power-factor was almost 60 per cent larger than would be required with system operated at 90 per cent power-factor.

Drawing-Board Method.

The drawing-board method is the only clear way to explain power-factor. Many men have no idea what inductance means, but they do know how to measure the sides of a right-angle triangle. Any man who knows how to read his meters and knows approximately what load his motors are driving can learn how to draw a clear-cut vector diagram of this system. When you once get such a picture you will be astonished how easy it will be to demonstrate the effect of any changes of motor loads or additions of new

motors to the circuit. You can tell in advance just what effect a new motor will have—how the characteristics of certain loads as driven by individual motors may produce low power-factor—how the



A 300-Horsepower Synchronous Motor Driving Centrifugal Pump.

grouping of certain loads on a line shaft to be driven by one motor may raise the power-factor and improve the efficiency of the whole plant. In fact, you can lay your finger on the cause of your present trouble, if there is any. And you can experiment in advance as to methods of raising power-factor and lowering current consumption.

The Leaning Ladder.

There is one simple illustration which I always use in explaining power-factor.

Suppose the roof of a 10-story building was on fire and the firemen had a ladder which was just the height of the building. Then suppose the firemen were to place the ladder leaning against the building at an angle of 45 degrees. The ladder would only extend to the seventh-floor windows. The three top floors would be beyond the firemen's reach. There would be only two remedies—either get a longer ladder, or shove the ladder up close to the building until it stands nearly vertical.

In its slanting position the ladder has a power-factor of 70 per cent; in the vertical position it has a power-factor of 100 per cent. In both cases it is still the same ladder. But in one case it reaches the tenth floor; in the other case it reaches the seventh. The angle at which it leans makes the difference.

Just so with your electric current—it is the angle at which it "leans" (or lags) that makes the difference. Lagging power-factor cuts down the capacity of a generator in the same way as the capacity of the ladder is cut down.

Causes of Low Power-Factor.

The principal causes of low power-factor are induction motors running at part loads and lightly loaded transformers.

Many induction motors have a fairly satisfactory power-factor when operated at full load, but the percentage of power-factor drops off rapidly for part loads, and when a motor is operated at anything less than half load the power-factor is very bad indeed.

J. S. Jenks, vice-president of the West Penn Power Company, at Pittsburgh, relates his experience with a power customer who was operating his motors at about one-tenth load. The customer bought his motors on the following plan: He first got the manufacturer's recommendation as to size of motor, being very careful to stipulate that he wanted liberally rated motors. Then he multiplied this rating by two, and if the result was not one of the standard size motors built by the manufacturer, he took the next larger size. He said he wanted to be dead sure that he would never have any motor trouble.

Complaint of Poor Regulation.

The consumer made the complaint that the voltage regulation was very poor. He was served by a four-mile, 6600-volt line built from a substation. Investigation showed that the regulation of the voltage at the substation was perfect, as there was large synchronous apparatus for maintaining constant transmission voltage. No amount of argument could induce the customer to re-arrange his motors so that they would operate at higher power-factor. As a result, the central station had to put up larger transformers and reinforce their line so as to carry the wattless component of the load back to the substation, where they took care of it with their synchronous condensers.

As a sequel to this, Mr. Jenks states that today the customer is still taking power under the same conditions but he is now paying a penalty for his low power-factor, and I think we will all agree that the penalty is justly imposed.

In the plant of the Lockport Glass Company, Lockport, N. Y., a power engineer was able to bring the average power-factor up from 70 to 88 per cent by changing the induction motors which were considerably oversized. This affected a saving of nearly $2000 a year in their power bill.

But no matter how carefully induction motors are selected, it is impossible to keep them operating in actual practice, under the ideal conditions of full load. Many motors must be run at part loads due to the requirements of the machines which they are driving.

The Remedy.

Proper use of synchronous motors on a power system offers the remedy for low power-factor. In all probability there are machines on power lines now driven by induction motors that should be driven by synchronous motors. These include heavy-duty, constant-speed machines such as compressors, fans, pumps, crushers, grinders, line shafts, etc.—in fact, any machine requiring 100 horsepower or over and operating at constant speed. Reasonably high starting torque and high pull-in torque are characteristic of synchronous motors as now designed. If the starting conditions of the load are especially severe, it may be necessary to install a clutch.

The electrical engineer of one of the large rubber companies stated that his company had installed two condenser sets of 2000 kilovolt-amperes each, in order to maintain the power-factor above 90 per cent, and thus obtain the very best rate which the central station would allow. This engineer admitted that the proper use of synchronous motors on their line shaft drives would have materially reduced the necessary condenser effect required and would also add to the over-all efficiency of the entire plant.

The load-factor of a large compressor is generally high, and if the plant is buying central-station power, the question of power rates is very important. Since the power-factor can be maintained at unity, or leading, a favorable rate can be secured. It is now universally agreed that the synchronous-motor-driven compressor is the most economical unit to install. For, in addition to its unity power-factor, it maintains very high efficiency and produces the maximum air pressure per kilowatt-hour input.

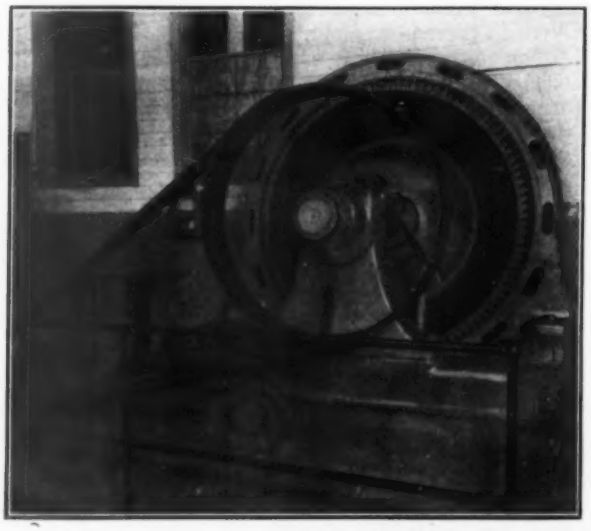
Large pumps generally have a very good load-factor, and for this reason form an ideal load for synchronous motors. The same advantages as to high efficiency and power-factor hold good. It will frequently pay to group certain loads on a line-shaft to be driven by a single large motor. Whatever slight losses are caused by belts, etc., are more than offset by the higher efficiency obtained on the large synchronous motor and correction of power-factor of the interior system.

The Proper Location for Synchronous Apparatus.

In order to get the best results in power-factor correction, synchronous motors should be located near the causes of lagging power-factor, namely, the induction motor load. In this case the reactive component circulates only between the induction motors and the synchronous motors and thus the power-factor of the customer's load is raised while the system and generating plant are relieved entirely of this wattless component.

Comparison of Induction and Synchronous Motors.

In the case of an induction motor too large for its load, the result is low lagging power-factor. But if a synchronous motor is larger in kilovolt-ampere capacity than the load requires, the result is leading power-factor with a consequently larger corrective effect on the system. (It is understood that proper excitation is supplied.)



A 1150-Horsepower Synchronous Motor Driving Pulp Grinder.

Induce Your Power Consumers to Install Synchronous Motors of Liberal Capacity.

Here is the point which power companies' salesmen now overlook. The customer can readily be induced to put in a unity power-factor synchronous motor just large enough for the load it is to carry in kilowatts. But, if some inducement was made by the power company, he would be willing to put in a large synchronous motor (necessarily of slightly lower efficiency in kilowatt output), and allow it to run at leading power-factor.

Case after case has come under the writer's observation where the customer was willing to install a synchronous motor of just sufficient kilowatt capacity to carry the load at unity power-factor. A very little persuasion on the part of the power company would have caused him to put in a larger motor, which could have been operated at full kilovolt-ampere capacity and leading power-factor at all times. But, in every case this persuasion on the part of the power company was lacking, and the customer bought the smaller size synchronous motor for unity power-factor operation.

Thousands of kilovolt-ampere condenser effect could be added to power systems if there was a little more co-operation on this point.

FINDING SUBSTITUTE MATERIALS.

Why Central Stations Should Co-operate in Solving the Problems Confronting Many Manufacturers—And a Hint for the Latter.

By Albert Scheible.

While the importance and timeliness of their products may enable electrical manufacturers to continue without interruption during the war, and may help them through priority orders to their needed supplies of raw materials, the same conditions do not apply to other lines of manufacture dependent upon central-station service for both light and power. Already many of this latter class are feeling the effect of the discrimination which is being so logically exercised by the authorities against the use of certain raw materials for products which are being classed as non-essentials during the continuance of the war. Consequently, some of these manufacturers have already been obliged to curtail their output, and others are even threatened with the necessity of shutting down their plants altogether, unless their line of manufacture can be suitably shifted. Logically, many of the manufacturers thus affected have turned to the making of articles for consumption by the Government during the war, but others may not find it feasible to make the desired arrangements or to adapt their equipment to such purposes. This latter class promises to include either part or all of the capacity of thousands of industrial plants scattered through the country and heretofore counted among the steady and profitable customers of central stations. Consequently, the problem facing these plants, or threatening to face them before the year is over, is one of vital interest to the electrical industry and one to which central-station men ought to give serious attention with a view to aiding such customers in the readjustments needed for continuing their industrial plants in steady and profitable operation.

Why Electrical Men Are Interested.

Unfortunately, the manufacture of munitions and other items for the War Department has been practically the only solution heretofore suggested to manufacturers, and where this alternative would not meet the circumstances, the manufacturer has been left to grope rather blindly in his search for substitute materials or substitute products. In large concerns boasting experimental departments, this situation has been

anticipated, to some extent, and steps have already been taken toward the needed changes. However, the much more numerous smaller factories have been left adrift and unless assisted from outside their own establishments a considerable share of these may be obliged to discontinue part or all of their manufacturing until the close of the war. This class of manufacturers undoubtedly includes a large number who would gladly continue their establishments in steady operation if they knew where to turn either for substitute raw materials or for substitute products of their manufacture, or to some extent for both. Indeed, some of these to whom the situation already seems depressing, and others who may deem it as hopeless unless some solution is indicated to them, may only need the stimulus of an optimistic suggestion to start their thought along new lines which may lead to the desired results; and, since even the offering of promising suggestions along this general line will be conducive towards the continued friendliness of manufacturers to the electrical industries, it seems highly proper that electrical men should be in the fore-front of those analyzing this situation and discussing it with the manufacturers among their customers.

Are Our Manufacturers Provincial?

That such a course should lead to tangible and highly desirable results may be assumed from the obvious fact that American manufacturers in general show an interesting combination of versatility and inertia. In other words, the same originality and versatility which has enabled Americans to produce a range of manufactured products second to none should also enable the industrial manufacturers to adapt themselves to the unusual conditions which some are facing already and which are likely to confront others before the year is over. However, as might be expected in a country wherever the continued manufacture of certain articles has proven a steady source of profit, the average manufacturer has been narrowed in his outlook both by the concentration which intensified operation demands and by the provincialism which has restricted his range of observation almost wholly to what has been going on in this country. Nor has this provincialism (which we might as well call by its proper name, regardless of whether or not we like to plead guilty of it) been confined to shop practice or to manufacturers. A moment's reflection will remind any reader of our newspapers and periodicals of the extent to which, for example, the customs of the French people have been disclosed to us within the past year in so far as they relate in any way to the conduct of the war. However, aside from an increased familiarity with the decimal system and with French types of war appliances, we in this country are still largely unfamiliar with the distinct differences between products of French manufacture and those of our own country. Consequently, we cannot undertake to draw comparisons, and much less to adapt for our own purposes such items of French manufacture as may offer decided advantages over the corresponding American products.

The same applies in general to the wares made elsewhere on the European Continent, and in the absence of even a meager familiarity with what Europeans have produced, the average manufacturer in this country is limited in his horizon to what has been on the market here. Consequently, the sudden demand for changes involving either a substitution of other materials, or the substitution of entirely different products for at least a part of his former output, leaves the American manufacturer quite at sea. Versatile though he may be, he may need suggestions from outside his past range of experience and observation to start him along new lines of thinking, experimenting and exploiting.

Storehouses of Valuable Suggestions.

And where is he to turn for such suggestions? Obviously, the British trade journals might be first consulted, but the British practice along most lines does not differ as much from the United States practice as does that of Continental manufacturers.

Among the journals of Europe can be found a wealth of information, including suggestions that ought to be utilized and adapted to a much larger extent than heretofore by American manufacturers. A study of many of these papers gives enlightenment into the ways and customs of a country and offer magnificent opportunity for a manufacturer to determine what will find ready market in foreign marts.

What is more, the presence of such comparatively large numbers of highly trained technical men has resulted not only in circles of readers warranting high class publications rather out of proportion to their support as judged by American standards, but has also resulted in much more extensive contributions by such men to these periodicals. This is apparently due partly to the fact that large numbers of these highly trained men have found no adequate outlet for their training in their regular occupations. Consequently, these men like to break into print, both for the satisfaction of seeing their names attached to articles reflecting their knowledge and ability, and for the compensation paid by various journals for such contributions. Likewise, these men enjoy taking part in discussions before technical societies, which discussions are reported also in their publications.

The foreign language technical press should augment those in the English language, for much of the foreign-language technical press contains much valuable material about problems similar to those in America, and problems that are different.

Exploring These Storehouses.

Fortunately, the men in charge of some of our prominent American libraries have been well aware of the storehouse of information which has thus been accumulated. In Chicago, for example, thousands of volumes of such technical journals, together with allied technical books, have gradually been gathered in the local libraries. Consequently, this wealth of information is available to American manufacturers and ought to be utilized far more extensively than has heretofore been the case.

Of course, the particular aim of such an investigation in each case must vary with the situation before the individual manufacturer, but the underlying thought is the same, namely that *American manufacturers ought to save both time and expense by acquainting themselves with what Europeans have done along any proposed line,* and by adapting this work to *American needs* and to *their own manufacturing facilities.* Armed with this definite suggestion, those interested in light and power plants will have something definite to propose to such patrons as are facing the difficulties to which I have referred, and if even a small part of these follow the above suggestion, the result should be beneficial not only to our central stations but also to American industries and commerce in general.

AMERICAN ELECTRICAL GOODS REPLACE GERMAN IN CHILE.

Of all the countries on the west coast of South America, Chile offers the best opportunity for the immediate sale of electrical goods, and the prospects for the future are bright. Germany dominated the market before the war, but according to a report recently issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., American goods have recently made big gains. German goods had entered the market in the wake of German capital.

Chile is a country where the natural resources and the will of the people make for progressive development along industrial and manufacturing lines, which means a steadily growing demand for power. Special Agent Philip S. Smith, author of the Government's report, asserts that this should and will be furnished by harnessing the many waterfalls of the Cordillera of the Andes to electric generators and sending the current to all parts of the central sections of the Republic.

One of the things that should not be overlooked in contemplating Chile as a future commercial field is the opportunity of uniting a safe investment with a profitable business. If advantage is taken of this situation the relations already existing between the two countries can be strengthened to their mutual profit.

The report analyzes every phase of the electrical-goods business in both Chile and Bolivia and is designed to assist American firms in their efforts to build up and maintain business with the two countries. Under the title "Electrical Goods in Bolivia and Chile," Special Agents Series No. 167, it is sold at the nominal price of 20 cents by the Superintendent of Documents, Washington, D. C., and by all the district and co-operative offices of the Bureau of Foreign and Domestic Commerce.

MONTANA PLANT INCREASED.

The Rainbow hydroelectric plant of Montana Power Company, at Great Falls, has been increased in capacity within the last year, by the installation of two additional units of 6200 k.v.a. each, giving the plant a capacity of 50,000 kilowatts.

ELECTRICALLY OPERATED HYDRAULIC DREDGE APPLIED TO COPPER-BEARING MATERIAL.

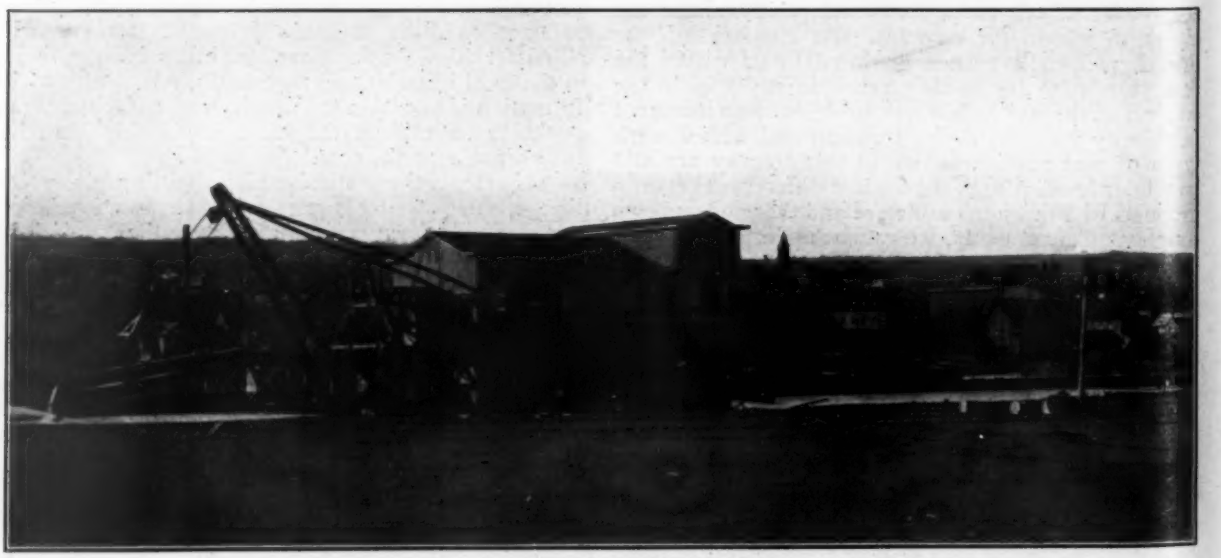
Interesting Facts About Calumet & Hecla Plant at Lake Linden, Mich., for Recovering Copper Tailings.

Electrically equipped dredges, of both the suction and bucket types, are widely used for the recovery of placer gold, and in some localities to obtain platinum and tin. But we know of only one place where a dredge of any type is employed in the recovery of native copper.

The accompanying illustration affords a general idea of how the Calumet & Hecla Copper Company has worked out a dredging and concentrating problem on mill tailings at Lake Linden, Mich. The tailings being treated are under water, in Torch Lake, but near the shore line. They were deposited there during the earlier years of copper mining in the Lake Superior region, when milling methods did not result in the high percentage of saving that is made today. Millions of tons of tailings dumped into the lake at this place contain enough copper to make it profitable to handle them.

The suction is produced by two 20-inch centrifugal pumps, one driven by a 1200 and the other by a 900-horsepower motor. The suction discharge is into a motor-driven rotary screen by which waste rock is eliminated. The material is pumped thence to a shore plant, into a dewatering tank, and then by a motor-driven belt conveyor to bins, from which it is fed into Hardinge mills. This pulverizing process reduces the rock material to such fineness as to release the particles of native copper, most of which are then recovered by gravity concentration on Wilfley tables, some of the metal in the form of slime being saved by oil flotation.

The machinery in the shore plant is electrically driven throughout. Every phase of the entire operation is either mechanical or hydraulic, with electricity as the motive power back of it all. While we are unable to give costs, values of material and percentage of recovery, it is understood the project is commercially very successful. It may be observed that the material handled is confined to that in which the gangue rock has native copper disseminated through it.



Electrically Operated Hydraulic Dredge for Recovering Copper Tailings Under Water.

Improved Lighting of Automobile Manufacturing Plants

Phenomenal Growth of Industry—Extensive Use of Efficiency Methods —Advisability of Utilizing Latest Lighting Developments—How Good Lighting Pays for Itself—Features that Need Special Improvement

By F. H. BERNHARD

PHENOMENAL development has characterized the automobile industry throughout its life of but little over twenty years. No other large industry has had so rapid a growth. United States census statistics show that in 1899 about 3720 automobiles valued at about $4,748,000, were made in this country. The last census data available are for 1914 and show during that calendar year there were produced about 570,000 automobiles valued at approximately $459,000,000. This represents an increase in only 15 years of over 150 times in the number of complete machines made and nearly 100 times in value. In 1914 the census report placed the industry in the sixth place as to the value of its products.

The astounding rapidity of this development is due to a number of causes, chief among which are the following: First, concentration of inventive genius in perfecting the self-propelled car, and second, the distinctive American genius for organization, which has been marked in this industry almost continually since its modest beginnings. This combination of effort has made the automobile a sturdy and reliable machine and brought it within the reach of so large a part of our population.

A feature of the automobile industry is the readiness with which it has adopted the most progressive manufacturing equipment and methods, including scientific plant layout and routing of processes, most efficient machinery, highly developed division of labor, progress of work according to time studies, systematic keeping of production and cost records, attention to heating, ventilation and lighting of plant, etc. While this has been true of nearly all the larger plants and has accounted largely for their supremacy, the smaller plants are still slow to recognize the importance of some of these factors in efficiency of manufacture, notably lighting. In certain places one also finds room for considerable improvement in lighting in the larger automobile factories, but in general it is the smaller establishments in which need for radical lighting betterment is greatest. This is because the importance of good lighting has not received proper recognition.

At the present time a large part of the automobile and accessory factories are engaged on urgent contract

Night View in Plant of Continental Motor Manufacturing Company, Detroit, Mich. Uniformly Distributed Illumination From Mazda C Lamps With Porcelain-Enameled Steel Reflectors.

work for the Government, including army trucks, tractors, ambulances, tanks, submarine chasers, airplanes, and miscellaneous munitions and supplies. Production is speeded up to top notch and overtime and night work is the rule. Increasing inroads of the draft are decreasing the number of skilled employes and making the labor problem more difficult. All this calls for renewed consideration of plant lighting, both to prevent any falling off in the production rate during night work and to prevent increase in accidents and spoiled product due to new and comparatively untrained employes.

The normal output of automobiles, especially pleasure cars, is now considerably restricted owing to the more urgent needs of the nation for steel and other raw materials required for successful prosecution of the war. At the conclusion of the conflict the orders that are now piling up will doubtless tax the capacity of the plants and this will mean, no doubt, continued or redoubled night work. Moreover, in all likelihood all industries will be called on to find suitable work for disabled soldiers, many of whom will have impaired eyesight. Evidently the need for the best possible lighting will be greater after the war than ever before.

Even though a plant may have put in what was considered to be a very good lighting system a few years ago, it should be remembered that lighting developments have been rapid and the replacement of parts of the equipment, at least, may be fully justified by the superior illumination results that may thereby be obtained. Thus, the new dome types of reflectors give a much better distribution of the light, illuminating vertical surfaces more effectively and reducing the annoyance of dark shadows. Many present lighting installations that are otherwise quite satisfactory show considerable glare from exposed parts of the brilliant lamp filament which impairs visual efficiency, thereby affecting the rate or quality of production. In some cases large numbers of small lamps are used for localized lighting with the usually resultant great contrasts of light and dark areas, dense shadows, excessive glare, high maintenance costs and generally poor lighting and poor efficiency.

The substance of the situation is that even in fairly well lighted plants there is considerable opportunity for introducing what formerly were looked upon as refinements, but which in the light of modern developments are essentials to complete satisfaction in lighting. The cost of making such changes is usually comparatively very small and quickly repays itself in the better visual conditions obtained. Certainly, in an industry which has paid such very close attention to efficiency methods and which has not hesitated to adopt the latest ideas, if these brought about any improvement in production rate or quality of products, there should be given the closest scrutiny to possible improvements in plant lighting, which plays a much more important role in over-all plant efficiency than has heretofore been recognized.

The Principal Advantages That Improved Lighting Brings.

The perfection of manufacturing organization in the automobile industry is due to a large extent to the activities of efficiency engineers who have studied every detail with stop-watch precision. Among some of these men and also among quite a few factory managers and superintendents there is a tendency to question any improvement unless its advantages can be predetermined with almost mathematical accuracy. All the benefits obtainable from improved lighting cannot be set forth with such accuracy for reasons to be discussed below, but they are not less real and positive on this account.

Light affects a person primarily through its effect

Lighting One Department of the Dodge Plant, Detroit, Mich. Excellent Illumination From Mercury-Vapor Lamps. Outer Rows of Lamps Are Placed Along Windows to Duplicate Direction of Natural Light on Benches and Machines.

Machine Shop of an Automobile Plant That Is Well Lighted by Mazda C Lamps With Carefully Selected Reflectors.

on the eye and secondarily through its effect on the mind. Quantitative determinations of physiological effects are quite difficult and of psychological effects still more difficult. The problem of lighting is itself quite complex, since it involves such important variables as intensity, direction and diffusion of the light supplied. A person's efficiency is the composite result of many variable influences. Obviously, determination of the effect of certain lighting changes on the efficiency of a workman or on the amount of work he turns out is a difficult problem that can be solved only when all conditions are known and remain constant while the lighting is changed.

Tests of the effects of bettered lighting on production rate have been made in a number of cases, however, and with no uncertain result. Invariably it has been found that it accelerates production, due to better visual conditions, that is, improved ability to see without eye strain or fatigue, which means time loss in almost every operation, due also to elimination of other time losses, such as outright loafing, which is common where poor lighting hinders proper supervision; due also to reduction of mistakes caused by poor lighting which choke up the entire production process in certain departments just as a bar dropped among the gears of a machine throws it entirely out of commission; and finally due to other contributing conditions, such as more cheerful environment and improved contentment of workmen.

Of course, it is impossible to tell exactly how much benefit in increased efficiency and greater output is obtained from each of these contributing advantages of improved lighting, but the point to be remembered is that they do unmistakably contribute to speeding up the work, which is frequently entirely unconscious on the part of the workers. The net result can be ascertained in actual percentage increase of production in many cases, especially where the piece-work system of payment prevails. In one instance of this kind it was found that eight per cent increase in pay was the average in a department after the lighting had been modernized. Even where wages are not based on the piece system, the usually complete records of automobile factories should permit a definite ascertainment of the amount of increased output following improvement in lighting, which in the case of straight per diem payment is, of course, pure velvet to the manufacturer.

No instance is recorded where a manufacturer has denied such an increase to have been noticed. Although some are reluctant to admit the extent of the increase for one reason or another, others openly express their conviction that it amounts to 5, 10 or even more per cent, in any case an extremely valuable consideration.

Aside from this matter of prime importance, probably the next most important advantage derived from better lighting is the reduction of accidents to the employes. In the records of state industrial commissions and factory inspection departments, as well as of accident insurance companies and safety organizations, is found indisputable evidence that industrial accidents occur much more frequently in the winter months than in summer, a 100 or more per cent increase being not uncommon. While a number of causes contribute to this increase, safety experts who have analyzed a vast number of reports agree that the increase is largely due to the greater dependence on artificial light that is necessary in winter. If this artificial light were as bright, well distributed and in other respects as satisfactory as daylight, it is obvious that this statement as to the effect of present artificial light on accidents would not be made. Evidently the average artificial lighting now provided is very unsatisfactory on this score alone. Safety experts are generally agreed, moreover, that nearly 25 per cent of all accidents could be eliminated by improved lighting.

No data are available as to the number of accidents occurring annually in the automobile manufacturing industry; they run into the thousands, however, and represent a vast loss in wages to the workmen and in damages paid by the employers as compensation for injuries, not to mention the loss of productive time while the injured men were disabled. This money loss by the manufacturers would alone doubtless have

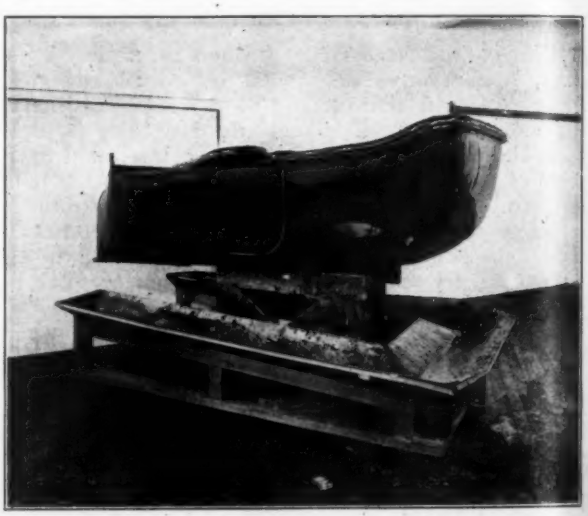
paid for the installation of the most perfect lighting systems, fully equal to the important features of day light. This has been the finding in the states of Massachusetts and Wisconsin respecting industrial accidents in general.

One other advantage derived from good lighting must be discussed. Although already referred to, the effect of improvement of lighting on quality of work done and reduction of mistakes and resultant spoilage is marked. This follows from the improved visual conditions mentioned above. The loss from outright spoiled material is very heavy, as is that from inferior product commonly called "seconds." While much of this is due to carelessness, a very large part is caused by mistakes for which poor lighting is properly to be blamed. Especially is this true of new employes, large numbers of whom are now engaged in the industry. The remedy is evidently a decided improvement in lighting, so that these new employes, whether disabled soldiers, women, boys or immigrants, may have the best possible conditions for seeing their work properly and without fatigue.

How Good Lighting Quickly Pays for Itself.

Although it is difficult to interpret the foregoing advantages in dollars and cents, it is not so difficult to show that the cost of lighting is very low in any case.

Block Engine Testing Department, Continental Motor Manufacturing Company. Mercury-Vapor Lamps Hung High Give Satisfactory Lighting.



Body Finishing in Studebaker Plant. No Daylight Used. Lighting Exclusively From Mercury-Vapor Lamps to Give Uniform Production.

Prof. C. E. Clewell, one of the best known authorities on industrial lighting, quotes the following unit costs based on certain new additions of the Ford Motor Company. The cost of the buildings and equipment is $1.64 per square foot of floor area and the cost of providing the lighting installation is about 5 cents per square foot, or just about 3 per cent of the entire first cost. The cost of lighting a unit area of 1000 square feet, including operation, interest, depreciation and maintenance, is about $80 per annum; the total labor and overhead cost for the men employed in such an area is probably about $80,000 per annum. Thus the entire annual cost of lighting is only in the neighborhood of 1/10 of one per cent of the labor and overhead charge.

Assuming each man to be paid $5 per eight-hour day, his wage amounts to about one cent per minute, whereas the cost of the entire lighting for a day amounts to only a fraction of a cent per man. Consequently if the lighting enables the man to save a minute a day it clearly has more than paid for itself. The fact of the matter is that it would have to be a comparatively poor lighting system that could not save a man more than one minute a day.

If we think of the great number of distinct operations a man performs a day wherein he has to change the iris opening of his eyes to accommodate for different light intensities, each of which involves a definite loss of time, even though it be only a second or even less, it is readily understood how the provision of more uniform illumination on his work may alone result in quite a few minutes of time saved per day. These time losses due to accommodation increase with the age of the employe and with the contrasts between the bright and dark areas in the ordinary range of vision associated with his work. With the very dense shadows still so prevalent in many factories this loss of time is a serious one, besides being a source of mistakes and accidents. It is unnecessary to dwell on other serious time losses, such as involved in setting micrometer gauges under an inadequate or poorly distributed light, quiet siestas in secluded and ill-lighted places, and countless other means whereby anywhere from a minute up is allowed to slip by.

In view of the evident value of recovering such lost time through good lighting it is needless to expatiate on the money value of the other incidental advantages of such lighting already alluded to. But these are themselves of utmost value and would justify the small expense involved in rehabilitating the lighting along the most approved modern lines. In many cases this does not even necessitate rewiring the lighting circuits, nor of junking all the lighting equipment.

Features Wherein Lighting Should Be Improved.

The most important feature of any lighting system is adequacy of illumination and it is this that is so commonly deficient and productive of needless eye strain. Our ideas of what is adequate illumination intensity have undergone rapid change in recent years with the improvement in efficiency of light sources. Intensities of 10 to 15 foot-candles on the working plane are not at all uncommon now that it has been shown they can be obtained economically by utilizing the increase in lamp efficiency to give increased illumi-

Upholstering Automobile Seat Cushions Under Abundant Light of Mazda C Lamps With Steel Reflectors.

Rubay Auto Body Company, Cleveland, Ohio. Good Illumination Obtained From Mazda C Lamps With Steel Reflectors.

nation. The closer we approach the most effective values found in shop interiors under the best daylight the better the results that are obtained by artificial light. As a rule, we have far to go in order to approximate daylight conditions in this regard, yet it is not only feasible but actually done in the largest automobile factory in the world.

This plant is operated on three eight-hour shifts and is able to maintain daylight production throughout the 24 hours per day. The lighting system is very efficient and the maintenance cost low. General lighting is provided from high-hung mercury-vapor lamps, whose light is not found objectionable to the workmen. There is absolutely no eye strain and fine detail and micrometer work is facilitated by the acuity of vision obtained.

Not only is it possible to duplicate the intensities of daylight in a plant, but in some respects to improve on daylight, especially as to constancy of illumination. It is to obtain the uniformity of production that in the body-finishing departments of some plants no daylight is used whatever, but all the light is obtained from artificial sources giving efficient light of steady intensity, direction and uniform color value throughout the 24 hours.

Although the use of the inefficient carbon-filament lamp is rapidly becoming uncommon in all progressive plants, it is still rather frequent that one finds the vacuum type tungsten lamp in small sizes employed. Almost double the light is obtainable from the gas-filled lamp known as the Mazda C due to its greater efficiency, and its light is also whiter. There is little excuse for using a multitude of low-wattage lamps when every advantage of efficiency and wiring economy dictates use of fewer and larger units properly equipped with suitable reflectors.

Reduction in the number of lamps and use of larger units necessitates higher mounting, which is incidentally advantageous for a number of reasons. It gives a more cheerful appearance to the entire workroom and gives a much more satisfactory illumination in every way than is obtainable with localized lighting, which usually has meant a multitude of small lamps hung low and an entire absence of general lighting. General illumination from high-hung lamps gives a much better light distribution as regards uniformity and also as regards providing illumination on vertical surfaces, although this depends upon the type of reflector used. Still another and extremely important advantage of high mounting is that it removes the lamps from the ordinary line of vision and thereby happily reduces glare. This matter will be discussed at more length below.

Selection of lamps and reflectors as regards type

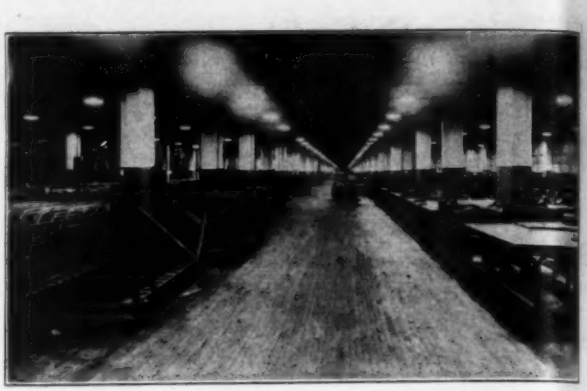
Assembling Department, Stewart-Warner Speedometer Corporation, Chicago. Indirect Lighting to Secure Glare-Free and Uniform Illumination.

and size is a matter that requires considerable judgment and, in fact, the design of a satisfactory lighting installation as a whole is a problem that should not be undertaken by anyone unskilled in this art. Too frequently one finds the old common type of tin shade or similar makeshift used. There is no excuse for this practice whatever, especially in plants like automobile factories which consider so carefully the matters of efficiency and maintenance. The only point in favor of the tin shade is its low first cost. It has very poor efficiency as a reflector, it seldom gives satisfactory light distribution and its durability is very low.

A reflector that meets the requirements of good industrial lighting is a device that combines scientific design and carefully developed mechanical properties.

In the first place, the shape of the reflector determines the character of the light distribution, and this is further affected by the relative position of lamp filament and reflector. Moreover, the reduction of glare must also be considered in reflector design. From the mechanical standpoint, the reflector should, of course, be a rugged piece of equipment, unless it can be hung in such a way as to be free from knocks and other abuse; the reflecting surface must be both efficient as to light reflection and of such durability that it will not readily corrode due to moisture, smoke, gases, etc.; furthermore, it must be easily cleaned, else its efficiency is only temporary. From the foregoing it is evident that considerable research is involved before a reflector of satisfactory properties can be placed on the market. For this reason it is advisable to purchase reflectors made only by firms of established reputation and which have incorporated in their products both the research and manufacturing skill necessary to give the permanent satisfaction that is desired.

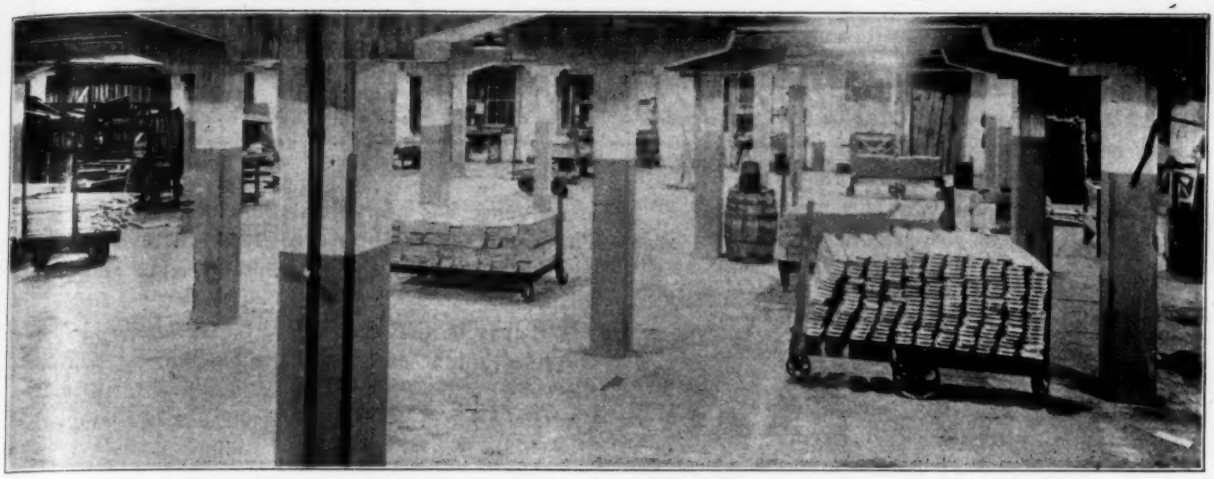
A development in the reflector line which has just taken place is the bringing out of porcelain-enameled steel reflectors constituting a standardized line made by the leading manufacturers. These incorporate the features briefly mentioned above and have been developed through the joint effort of lamp and reflector manufacturers, thus combining the best knowledge obtainable on this subject. These standardized reflectors are produced now only in the dome-shape form, but this form has been found to possess a number of advantages compared to the more shallow and the deeper bowl forms that have been used so extensively. This advantage is that the light distribution is broader, which means that more light is thrown down obliquely than was the case with the older types of reflectors. This means further that the sides of machines and work held in vises receive more light, which has been found highly desirable. Where the light is thrown almost entirely in a straight downward direction, the horizontal surfaces receive a preponderance of light and there is too much contrast between them and the rather obscurely lighted vertical surfaces. Another obvious advantage of standardized reflectors is the reduction in the number of types and sizes that have to be kept on hand by the maintenance department.



View in Dodge Brothers' Plant. Skillful Handling of Aisle Lighting Problem. Mazda C Lamps With Shallow Bowl Reflectors.

Mention has already been made a number of times of the subject of glare. This objectionable but un-

Body Assembly Conveyors in Maxwell Plant. Continuous Production Day and Night Made Possible by This Illumination. Mercury-Vapor Lamps Hung Close to Bottom Chord of Roof Trusses.



Illumination of Shipping Room, Mitchell Motors Company, Racine, Wis. Mazda C Lamps With Skirted-Cone Enameled Steel Reflectors.

avoidable accompaniment of modern lighting sources is due to the fact that in order to secure high efficiency and greater power in the units it has been necessary to greatly increase their intrinsic brilliancy. On the other hand, the higher efficiency obtained nowadays makes it possible to utilize some of this for securing the much desired improvement in diffusion. The subject of reduction of glare has not received anywhere near the attention in factory lighting that it deserves.

It is no uncommon sight to find a workman at a machine or bench using a bare lamp of 100 watts or even more almost directly at the level of his eye so that the brilliant light from this source is continually impinging upon the delicate mechanism of his eyes. This is just as pleasant a matter as can be experienced when facing directly against the brilliant sun while it is some 10 to 20 degrees above the horizon.

Glare can be reduced in a number of ways. High mounting of units is one of the simplest. If this places the lamps well above the ordinary line of vision and, furthermore, if the lamps are provided with reflectors that cut off direct view of the filament unless a person looks at them from almost directly below, very little objection from the glare standpoint can be found. If the lighting units cannot be hung so high, due to a low ceiling or other obstruction, it may be necessary to use bowl-frosted lamps or some form of diffusing globe or cap to either cut off or diffuse the light from the lower portion of the filament. Several devices of this type have been developed that give excellent results, one of them including a silver cap that fits snugly to the lower portion of the bulb and reflects back against the large reflector the light that otherwise would come direct from the exposed portion of the filament. Where work is being done on small parts or on highly polished surfaces, the matter of reduction of glare is of greatest importance and for this purpose it may be advisable to provide such special means of securing diffusion, by indirect lighting or use of semi-indirect or similar equipment.

View in One of the Shops of the Kissel Kar Company, Hartford, Wis. Mazda C Lamps With Silver-Mirrored Glass Reflectors. Former Drop Lamps No Longer Needed.

As to specific recommendations for lighting the different departments in an automobile factory, space does not permit comprehensive treatment of this subject. However, a few features may be pointed out in which it is evident that considerable improvement can be effected compared to the practice that is generally in vogue. One is the matter of lighting aisles. These are very important in any automobile plant because parts have to be moved from one department to another with dispatch and in such a way as to eliminate all possible accidents or other causes of delay. On account of the importance of these aisles and passageways, it is a common custom to place a row of lamps directly over the center of them. Unless special precaution has been taken to eliminate the glare from these units by one of the means pointed out above, this glare is likely to confuse the workman that is pushing a truck and cause him to collide with other trucks or obstructions with resultant delays if not injuries and loss. If possible, it is well to place the lamps at the sides of the aisles, or better yet, to so locate the lamps that light the machines on either side of the aisle, that the aisle is well illuminated without lamps directly above it.

Another feature that has usually not been given the attention it deserves is the matter of cleaning, lamp renewal and other features of maintenance service. It is, of course, self-evident that the expense and trouble involved in providing efficient lamp and reflector equipment is largely a loss if this efficiency is not maintained. This means that cleaning of lamps and reflector surfaces, renewal of blackened lamps or tubes, prompt replacement of broken or missing lamps, must be given frequent attention. In a large plant it is found that a separate maintenance department taking regular care of this matter of lighting efficiency works out better than to depend for this upon the foreman whenever he happens to think it needs attention.

Editorial Comment

The Government and the Telephone

THE Federal Government, for the duration of the war at least, has taken over the telephone and telegraph systems of the country and Postmaster-General Burleson will be in charge of them. Those of us who have experienced the delays and exasperations of the telephone service abroad when it is managed by the governments, will hope that no such results will follow here. If the Postmaster-General will retain as his authoritative counsellors and representatives the splendid staff of the present organization of the American Telephone & Telegraph Company, excellent results may follow through the added powers the Administration will have to consolidate facilities and management. This will especially apply, too, to the two telegraph companies and was the original idea of President Theodore N. Vail of the American Telephone & Telegraph Company when a few years ago he arranged a working plan of benefit to the public in combining the facilities of his company and the Western Union Telegraph Company. The Administration did not view this favorably and it was abandoned.

The public will note with close interest the present change and the Administration will find it a real test of its abilities in the field of co-operative control. There is no public utility service that so closely enters into our daily life as that of the telephone.

The New York *Sun* in a recent editorial says:

"President Theodore N. Vail, of the American Telephone & Telegraph Company, who has conferred with Mr. Burleson at length concerning this new application of Federal authority, is satisfied that Mr. Burleson intends 'to maintain the wire service at the highest possible efficiency, conserve and protect the property that it may be returned to the owners in as good condition as received, and to pay a compensation for its use that will be just and fair.'

"Mr. Vail knows more about the wire communication system of the country than anybody else; he would not use the words 'highest possible efficiency' loosely; and his optimism should comfort all those who have dreaded the intrusion of politics in an industry that has been notably efficient in the past.

"Mr. Burleson receives from the officers of the telephone company one of the most, if not the most, skilfully organized industries in the world. Nowhere outside of the United States has the telephone industry been developed as it has been here. In no other country is the use of the telephone as common; in no other country is the service as good as it is here. Every American returning from abroad to his home has rejoiced on being able to make use of the superior facilities provided by the telephone companies here, after his patience has been worn thin by foreign systems. The telephone service in the United States has been a triumph of initiative, intelligent direction and public spirit.

"It may be that the necessity of keeping telephone and telegraph accounts in a businesslike way will open the eyes of the Post Office Department to the undesirability of its present bookkeeping methods and bring about a much needed reform. Should this be the case, Government control of the wires will confer a lasting benefit on the United States."

Putting the Electric Motor to Work

PUT THE motor to work is advice at once sound, timely and urgent. When the motor can do what man once did, there the motor should go to work. It is needed now.

Not only has immigration ceased to all practical purposes but the flow has ebbed the opposite way, and labor has left these shores where once it came flocking to them. Thousands have left America to answer the colors of their own land—Britons, French, Russians, Poles, Italians and many more—in addition to our own 1,300,000 that have gone "over there." And the end is not yet. Thus has not only the normal labor supply ceased to exist, but what is left is dwindling fast. Put the motor to work.

The labor that remains, of neither the quality or quantity that existed in pre-bellum days, has been migrating from job to job, ever on the ebb and flow, leaving one path of effort for some other easier, better paid means of earning a livelihood. Skilled labor has become scarce, and the cost of labor has soared as employer has outvied with employer in tempting the worker, and the demand for workers is greater today than ever known before. Put the motor to work.

There is too much to do, too little time to do it, and too few workers for the work in hand to allow men and women to do what machines might do. Motor power is cheaper than man-power, and we refer to the *genus homo* rather than to *vir*. Motor-power never goes on strike, never gets tired, never suffers from lapses due various mental, physical, seasonal or other influences to which mankind, and women especially, are so prone. The electric motor is needed now as never before to take the place of human effort, to take the place of depleted man-power, to enable more intensified and sustained effort than is humanly possible. Much has, of course, been done toward motorizing machines, and applying machinery where once manual performance sufficed. But much still remains to be done toward putting the motor to work.

The entrance of women into fields of effort once

confined to men, and the continual broadening of these spheres, is largely made possible by the electric motor. A woman's most important work will forever remain in the home, although economic pressure, social influences and national necessity may take her out of the home to do work once done by men. Woman's work will remain woman's work to the end of time—but the motor can lighten it. The electric motor can lighten her task, permit her to do what she could not otherwise, and enable her to conserve her strength and health, upon which the future of the nation and the progress of the world so largely depend. No woman should be allowed to do what a motor can do, in factory or home. Extension of the draft ages and the return of soldiers and sailors incapacitated for further active service are other factors that will call for more intensive application of the electric motor in the days to come.

The electric motor—dependable and flexible—that answers to the press of a button, is today playing its important part toward winning the war. It will do much toward bringing back to usefulness to themselves and their country those maimed in the waging of war. And when we have won the war, and we and our allies go out after the commerce of the world, the electric motor will be a powerful factor in capturing the world's marts. In the days to come, even more than at the present time, it will be industrial suicide to allow men and women to do what the motor can do. To put the motor to work is, therefore, advice at once timely and sound.

Aiding the Handicapped Manufacturer

WHILE every patriotic citizen must applaud the measures which are being taken more and more extensively towards giving priority of raw materials to the war-aiding and the so-called essential lines, the effect of such regulations on the manufacturers whose supply of materials is curtailed by the same should not be underestimated. Moreover, any affecting of the manufacturers is sure to be far reaching in its influence, and the result is bound to be felt by practically all of the electrical industries. For example, if the curtailing of raw materials reduces the output of a given factory even one-fourth or one-third, the corresponding reduction in the amount of current needed for light and power forms only a small part of the detrimental effects felt by the central station on which this factory depends for its current. If a corresponding number of men are thrown out of employment, the use of current in their homes is sure to be reduced if they remain in that locality, or lost entirely to the neighboring plant if they move away. Or, if the result is merely a reduction in the working hours, the diminution in the purchasing power of the workmen will be felt by the stores at which they trade, so that still more of these may be forced to the wall.

Consequently, the central station will be certain to feel the effects from many sides and, with high operating and fuel costs and war taxes already burdening it, the central station is deeply and vitally interested in the continued operation of the manufacturing plants in its district. Of course, others besides those connected with the electrical industries will be affected also, and perhaps a concerted action somewhat akin to that taken by local business men towards inducing new factories to locate in their city will be desirable in many places. On the other hand, many a manufacturer may be able to solve his own particular problem if encouraged to do so and directed along promising lines. At any rate, the time seems ripe for the central-station management to show its deep interest in the welfare of its manufacturing patrons, and particularly so, as almost every manufacturer will appreciate such an effort even though it might not lead to directly traceable results.

In line with this thought is the interesting suggestion made in another column by Albert Scheible, based on his belief that the problems confronting a large share of the affected manufacturers will be either the selection of new raw materials as substitutes for the unobtainable ones in making substantially the same goods, or the shifting of the output to other products utilizing the available materials and manufacturing facilities. In either case, a saving in time and a reduction in the cost of experimenting is highly desirable, hence the timeliness of Mr. Scheible's suggestion that our manufacturers study and adopt the work of Europeans.

Maintaining Service Departments in Retail Stores

ALTHOUGH considerable attention is rightfully being given the subject of electrical retailing, sufficient emphasis has not been given to the importance of a service department in conjunction with a retail establishment. It is often stated that the sale of electrical appliances belongs to the electrical dealer by right of heritage, but it should be remembered that the hardware merchant or department store is generally much better versed in business methods, and unless the electrical dealer utilizes his superior electrical knowledge in giving better service to the public, he cannot expect to succeed.

Obviously, the electrical dealer has a decided advantage over his non-electrical competitors in his ability to give to his customers intelligent advice in the selection and use of merchandise. But what is perhaps more important is his ability to conduct a service department to make repairs, adjustments, etc. The Sterling Electric Company of Minneapolis and many other progressive electrical dealers consider a service department as a necessary adjunct to their business and responsible in a large measure for their success. No electrical retailing establishment is too small for a service department—incidentally, many can be conducted at a considerable profit.

Week's Events

Commonwealth Edison to Tie-In With Hydroelectric System—General Electric Wage Dispute Settled—Other News

COMMONWEALTH EDISON SYSTEM TO TIE-IN WITH HYDROELECTRIC SYSTEM.

Sanitary District to Operate in Parallel With Fisk, Quarry and Northwest Stations as War Measure.

What is perhaps one of the most interesting instances of interconnection of electricity supply systems is that now in the embryo stage in Chicago. The Commonwealth Edison Company and the Sanitary District are about to ratify an agreement by which the two systems are paralleled for interchange of energy. The contract has been drawn up and accepted by the Sanitary District and it now remains for the Commonwealth Edison Company to accept the terms.

Under the contract, which is binding only for the duration of the war, the unused hydroelectric power of the Sanitary District's 32,000-kilowatt hydroelectric plant at Lockport is to be made available for use by the Commonwealth Edison's system. This means that the Commonwealth Edison Company will be able to bank fires a little earlier and keep them banked a little later in some instances, allowing the hydroelectric plant at Lockport to carry load otherwise carried by the Commonwealth Edison Company's generating plants. The times when this will occur will be during the noon-hour slump, in the early morning hours, on Saturday afternoons possibly and during parts of Sundays. The service will be what the English have come to call "week-end" service, since the war. The intention is to enable the Sanitary District to supply hydroelectric energy when it has it to spare, thereby saving coal.

It is estimated that the coal saved will approximate 150 tons per diem, equivalent to about 55,000 tons of coal saved per annum, a comparatively small amount compared with the Commonwealth Edison's total annual coal consumption, but a goodly saving when placed upon a car-load basis. The price to be paid for energy by the Commonwealth Edison Company to the Sanitary District will be that equivalent to the cost of coal required were the energy obtained from the company's steam stations. With this arrangement the Sanitary District expects to obtain a revenue of about $450 per day, representing an income otherwise unobtainable with its existing load-factor and connected load. Physical interconnection is thus seen to be quite beneficial to the hydroelectric system. As concerns the Commonwealth Edison Company, the interconnection is of small if any benefit financially, but the moral is important, and the company has realized the necessity of doing everything in its power to save the nation's coal. The present instance is a good one of where two electricity supply systems, rivals and yet not exactly competitors, have connected their systems together, to good advantage of the one, of small if any gain to the other, as an act of patriotism and to help win the war. The cost of the physical connection of the two systems, to be borne by the Sanitary District, is estimated to be in the neighborhood of $7500.

ELECTRIFICATION PROGRESSES RAPIDLY ON MILWAUKEE & ST. PAUL RAILWAY.

Work Being Pushed on 200 Miles of Electrified Line in State of Washington.

Electrification of the Chicago, Milwaukee & St. Paul Railway's lines through the Cascade Mountains from Othello in Eastern Washington to Seattle and Tacoma, a little more than 200 miles, has progressed in such a satisfactory manner that service may be expected in less than one year. The eight substations are almost completed and by the end of August will be in a position for installation of electrical apparatus. These substations, each with three bungalows for housing the operating employes, will cost completed about $200,000 apiece. The trolley, transmission and other copper wires are to be drawn at a new wire mill, constructed by the Anaconda Copper Company at Great Falls, Mont. Delivery of electric locomotives will be made in the spring of 1919 and these will be given trial in the present electrified zone in Montana. They will cost about $200,000 each. The entire cost of the more than 200 miles between Othello and Seattle and Tacoma will be about $9,500,000. With the present stretch of 441 miles in Montana and Idaho, this will complete close to 650 miles of electrical operation of this railway's system.

COST DATA COMPILED THROUGH LABOR COST COMMITTEE.

Report Presented at Cleveland Convention of National Association of Electrical Contractors and Dealers Arouses Much Interest—Credit Due to Labor Cost Committee.

At the recent convention held in Cleveland by the National Association of Electrical Contractors and Dealers, as was reported in our issue of July 27, the paper that aroused probably the greatest interest and discussion was that giving a report on labor costs. This paper, which was reprinted substantially in full in our issue of July 27, pages 125-131, was read by John R. Smith, secretary of the Electrical Estimators' Association, which had compiled the data at the suggestion of the Labor Cost Committee of the National Association.

Directly after the New Orleans convention held last October, J. N. Pierce, of Chicago, was appointed chairman of the Labor Cost Committee. In considering what the report of the committee should be at this year's annual convention, Mr. Pierce brought to the attention of the committee the work being done by the recently organized Electrical Estimators' Association and he convinced the committee that the data being gathered by the estimators, which were based on the actual experience of leading contracting firms, were probably of more value than any that had heretofore been presented to the national body. Consequently, he

obtained the approval of the Labor Cost Committee to the compilation of the data and secured an appropriation from the National Association that would make this matter possible. As soon as the authority was given he arranged with the estimators to work day and night in order to present the data in proper form. This work was continued for several weeks and quite a number of copies of the labor cost data were prepared in the form of blueprint data sheets and also printed curve sheets.

The excellent impression that has been made by this report has led to the extension of the work of the committee and it is expected that further data will be compiled. Another matter now being taken up is the preparation of standard forms for estimates, which it is believed will be of great value to contractors throughout the country.

MORE POWER FOR WAR INDUSTRIES.

Council of National Defense Completes Plans for Increased Electrical Public Utility Capacity.

Plans have been worked out by the Council of National Defense for the enlargement of public utility electric power plant capacity and for building high tension transmission lines in eastern Ohio, western Pennsylvania and northern West Virginia, to insure war industries necessary power.

The scheme submitted by the Government engineers as vitally necessary to war work in this tri-state territory would involve an expenditure of $75,000,000, it is estimated. Provisions for financing the great project are contained in the recent recommendation of President Wilson that Congress appropriate $200,000,000 for this purpose in various industrial centers.

The result of effecting the electric power improvements recommended would be to tie up into one big inter-state system the local units in Pittsburgh and surrounding cities, Wheeling, W. Va., Youngstown, and a number of other eastern Ohio towns, and to increase the electric generating capacity of public utility plants in these towns from 400,000 kilowatts to more than 730,000 kilowatts. Nearly 100 miles of high tension lines are recommended to complete the circuits, the longest of which would be the one running to Bolivar, Ohio.

At present, Youngstown has capacity for generating 74,000 kilowatts. An addition of 75,000 kilowatts is recommended. Pittsburgh, under the plan proposed, would get an additional 140,000 kilowatts capacity, and the Wheeling, W. Va., district 90,000. Smaller units would go to some outlying centers.

CHANGES IN ELECTRICAL COMMITTEE IN CHARGE OF CODE.

National Fire Protection Association's Electrical Committee Loses Mr. Cabot as Chairman—Dana Pierce the New Chairman—Other Changes.

The Electrical Committee of the National Fire Protection Association, which has charge of the biennial revision of the National Electrical Code, has recently had a number of important changes in its personnel. Dana Pierce, of New York City, has been appointed chairman, succeeding F. E. Cabot, of Boston. The history of this important and well known committee extends over 22 years, during all of which period Mr. Cabot has been its chairman. His services to the electrical industries in this work have been recognized as of great value, and his resignation, due to the pressure of other duties, will be regretted by his wide circle of friends in the electrical field.

Mr. Pierce, the new chairman, is a vice-president of Underwriters' Laboratories, and is well known as the electrical engineer of that institution. He has been a member of the Electrical Committee for the past ten years and has been familiar with its history and procedures through constant association with all of its activities.

The following new members of the committee have also been recently appointed. Morton G. Lloyd, of the Bureau of Standards, Washington, D. C., (replacing W. J. Canada); K. W. Adkins, of the Missouri Inspection Bureau, Kansas City, Mo.; F. F. Burroughs, of the Mutual Fire Prevention Bureau, Oxford, Mich.; C. B. Landon, Factory Insurance Association, Hartford, Conn.; A. N. Miner, Jr., Underwriters' Bureau of New England, Boston, Mass.; H. R. Sargent, Schenectady, N. Y., representing the Associated Manufacturers of Electrical Supplies.

These changes in the committee have been effected just after the committee has completed its latest revision of the Code and publication of the 1918 edition, which is now being distributed.

ELECTRIC HOIST MANUFACTURERS OFFER COMPLETE CO-ORDINATION TO EXECUTE WAR WORK.

Interesting Meeting of Association at Montour Falls—Instructive Plant Inspection.

The Electric Hoist Manufacturers' Association held a meeting at Montour Falls, N. Y., recently. The 22 members present, representing the following named companies, were the guests of the Shepard Electric Crane & Hoist Company:

The Brownhoisting Machinery Company, Cleveland, O.
Detroit Hoist & Machine Company, Detroit, Mich.
Euclid Crane & Hoist Company, Euclid, O.
Link-Belt Company, Nicetown, Pa.
Roeper Crane & Hoist Works, Reading, Pa.
Shepard Electric Crane & Hoist Company, Montour, N. Y.
Sprague Electric Works, New York City.
Yale & Towne Manufacturing Company, New York City.

The principal topic considered at the meeting was that of war service, with the view to the utmost coordination of experience and facilities of the electric hoist manufacturers in rendering service to the Government in war requirements. Attention was called to the fact that these concerns are heavily booked on Government orders, and that the problem of securing raw materials in sufficient time to execute these orders as required had become a critical one. The consensus of opinion of the electric hoist manufacturers was that Government orders for war purposes should take precedence over all other orders; and that if war requirements call for the entire output of their plants it will be desirable to refuse all other business.

An interesting feature of the meeting was a visit of inspection to the plant of Shepard Electric Crane & Hoist Company. The matters that were gone into comprised design, manufacturing, shop costs, testing, technical history of installations and welfare work.

Visiting members were much impressed by the manner in which the Shepard Electric Crane & Hoist Company frankly opened its entire plant to its visiting competitors.

PORTLAND'S SIX-CENT FARE HELD LEGAL.

Supreme Court of Oregon Upholds Increased Fare Authorized by Public Service Commission.

The Supreme Court of Oregon has upheld Portland's six-cent street-car fare. In rendering the opinion of the court, Justice Bennett said: "The contention of the city in the main is that the franchise granted by its ordinance to the Portland Railway, Light & Power Company constituted a contract between it and the company, the obligation of which could not be impaired by the action of the Public Service Commission.

"The court holds in substance that the city could not have granted such a franchise unless the power to do so had been delegated to it by the state; that in granting the right to maintain the railway in the city, the municipality acted as a governmental agency of the state and really entered into the arrangement on behalf of the state; that the latter having delegated authority to the city and made an agent of the city for the purpose in question, could rightfully revoke that agency and establish another; that by the enactment of the public service law it had created such a new agency in the form of the Public Service Commission, giving it plenary power in all such matters.

"The conclusion is that by the general law relating to public service corporations, the state had a right to, and did in effect, withdraw from the city of Portland the agency authorizing it to grant a franchise to, or enter into a contract with the company for a five-cent fare and appointed another agency, the Public Service Commission, with full power to act for the state and that to this new agency the company had applied for a change in the agreement with the result that the parties to the contract, the company on one side and the state, represented by its Public Service Commission, on the other, mutually agreed to change the franchise or contract so as to allow the company to charge six cents instead of five. Without regard to what might be said if either party to the contract, or franchise, without consent of the other, should attempt to change it, either by legislation or otherwise, the impairment of the obligation of the agreement is not involved."

WESTINGHOUSE FACTORY AT ESSINGTON IN HANDS OF FEDERAL DIRECTORS.

Speeding Up Turbine Production Sought.

The turbine plant of the Westinghouse Electric Company in Essington has passed into Government hands as part of the nation-wide control of the turbine industry recently assumed by the United States. The Essington plant, under government supervision, will speed up in its production of steam land and water turbines, and make possible the culmination of the great merchant marine.

The Essington plant is one of 21 manufactories that have come under government control. According to government officials, the Westinghouse plant will play an important part in furnishing propelling power to ships for the Emergency Fleet Corporation and the United States Navy. "The government supervision of turbine factories," said Howard Coonley, vice-president of the Emergency Fleet Corporation, "is designed to facilitate shipments of turbine and allocate turbine supplies among the shipyards and other war industry agencies and fill the requirements in the fastest possible manner. It will speed production in a way that has not been accomplished before."

GENERAL ELECTRIC WAGE DISPUTE SETTLED.

Employes Granted Increased Wages by Federal Labor Board.

The national war labor board in Washington has handed down its decision in the wage and time controversy between the Metal Trades Council and the General Electric Company of Schenectady, N. Y. Important features of the decision made by ex-President William Howard Taft and Frank P. Walsh, joint chairmen of the tribunal and arbitrators by consent of both sides, are that the hours of work shall not be shortened at this time; that the present bonus of 10 per cent shall become wages except in a few trades which are to receive a 15 per cent increase; that women doing men's work shall receive an increase of 20 per cent; no woman shall receive less than $15 a week, and in no case shall a man receive less than 42 cents an hour.

Back pay will be given the employes as soon as it can be computed. The first payment cannot be made much before September 1 and the others will be made on or before September 15, the date fixed by the war labor board.

The work of computing the payrolls from now on, taking in consideration the increases allowed by the board, is a large task, and these increases may not be included in the pay envelopes next week. As soon as the payrolls are revised, the men will be paid according to the new scale. Some interpretations are to be obtained as to who come under the increases. Between 16,000 and 18,000 will be benefited. There are upward of 20,000 in the plant.

An estimate last night indicated that the back pay will aggregate $675,000. On this basis it is believed the increases mean an expenditure of more than $2,000,000 annually by the company.

The decision is along the lines which Vice-President George E. Emmons conceded to the men. The original demand of the Metal Trades Council was for a 44-hour week and a 25 per cent increase in wages. This was afterwards modified to a 48-hour basic week and a 20 per cent increase in compensation. A strike was scheduled to take place Monday, June 10, but on the previous Sunday a conference was held at which Vice-President Emmons agreed to give the men a 10 per cent increase except in the case of the steamfitters, patternmakers, broad and narrow gauge men, carpenters, metal polishers and shop painters. It was admitted these employes were being underpaid and they were given a 15 per cent increase. The 10 per cent bonus was to be paid as wages. In the case of piece-workers, the increase was to be retroactive to May 3, and in the case of day workers it was retroactive to May 6.

This was not entirely satisfactory to the men, but they remained at work and agreed to submit the controversy to the national war labor board. Vice-President Emmons had agreed previously to do this. Messrs. Taft and Walsh went to Schenectady Saturday, June 22. This hearing was supplemented about a week later by the men giving further testimony before Examiner W. L. Stoddard. This evidence was transcribed and presented to the arbitrators.

Commercial

Electric Pumping on Yellowstone—Smelting Plant to Increase Power Load—Appliance Sales of Illinois Company

PUBLIC SERVICE OF NORTHERN ILLINOIS MAKES NEW POWER RECORD.

The Public Service Company of Northern Illinois, operating in a large number of towns adjacent to Chicago, has been making notable progress in the acquisition of new power business from war industries, the total for the past six months being 7300.5 horsepower. The number of contracts and the horsepower involved for the eleven districts served by the company is as follows:

Number of contracts.	Horsepower.	Number of contracts.	Horsepower.
32	286	14	63.5
54	598.7	4	8
72	2935.9	5	44
18	29.5	20	164.9
36	2434.4		7300.5
36	504		
22	231.6		

During the month of June 2953 horsepower was added including 1000 horsepower for the National Malleable Castings Company for the operation of an electric furnace.

ELECTRIC PUMPING ON THE YELLOWSTONE IN MONTANA.

Centrifugal Pumps Being Used to Raise Water for Irrigation Purposes—Central-Station Power Being Used Advantageously.

The Lockwood Irrigation District, Billings, Mont., contemplates adding two more centrifugal pumps at its main pumping station where it already has three units consisting of three Worthington centrifugals by which a lift of 150 feet is made from the Yellowstone River to a distributing canal. Each pump is direct-connected to a motor, operating at a pressure of 2300 volts. One pump is driven by a 200-horsepower motor, each of the other two by a motor of 150 horsepower, all being of General Electric type.

The water, after being pumped into the canal referred to, runs two miles by gravity to a second pumping station by which a portion of it is raised 50 feet to another canal from which land on a higher bench is irrigated.

This relay station has a similar pump, operated by a 50-horsepower motor. The district uses central-station power for this work, supplied by the Montana Power Company.

In a somewhat similar manner, electric pumping for irrigation is to be employed at Forsyth, Mont., where centrifugal pumps, direct-connected to motors, and three transformers, have been installed on the bank of the Yellowstone River. The installation was too late for service this season, but the plant and all canals and ditches will be ready for the season of 1919. Power will be supplied by the local electric power company, at Forsyth, of which C. A. Beecraft is manager.

MONTANA POWER COMPANY HAS STEADY POWER AND LIGHT LOAD AT BILLINGS.

Over 800 Electric Ranges Maintained in City—Electric Pumping and Commercial Installations.

Billings is the most easterly point served by the electric system of the Montana Power Company. Most of the power consumed at this place is produced at the company's hydroelectric plant, with steam auxiliary, situated on the Yellowstone River, although the lines here are tied in with the main system farther west through an extension from the company's Madison River plant. The power load at and around Billings, dispensed through a large number of small alternating-current motors, amounts to 1500 kilowatts. A part of this is for pumping water for irrigating purposes.

Demands for energy, aside from that required for commercial, domestic and municipal lighting, are considerably augmented by the use of electric ranges, washing machines and vacuum cleaners. About 800 electric ranges are maintained in all-year service in Billings, which is not equalled in many towns of its size. This service is rendered on a basis of 3 cents per kilowatt-hour, and this is done in the face of gas competition. These are mostly the Hughes and Westinghouse ranges, a few new sales being made from month to month. Sales have been made at prices ranging from $90 to $115, on the plan of $25 cash and $10 per month.

An average of 10 washers and 24 vacuum cleaners per month are being sold. Aside from the advantage the company has of enclosing special literature to customers with light bills, much of the interest is kept up by local advertising.

The city of Billings is extending its area of ornamental lighting. A recent installation consisted of 37 five-light clusters, made up of four 40-watt and one 60-watt lamps, and contracts have been let for installing 44 more similar clusters. Cast-iron posts are used. The Montana Power Company handles this work itself.

ELECTRIC COOKING LOAD AT STOCKTON.

Since the beginning of the electric cooking and heating campaign of the Stockton (Cal.) division of Western States Gas & Electric Company a little over a year ago, nearly 1000 kilowatts of this class of business has been added to the company's lines. The following table shows the number of ranges and heaters sold and their total capacities:

101	Ranges ..... Total capacity	668.160 K. W.
89	Water Heaters ..... Total capacity	174.700 K. W.
84	Air Heaters ..... Total capacity	151.467 K. W.
1	Plate ..... Total capacity	.880 K. W.
		995.207 K. W.

The company's electrical energy output for the week ended July 18 was 26.1 per cent greater than for the corresponding week last year.

POPULARITY OF APPLIANCES SHOWN BY INCREASED SALES.

Public Service Company of Northern Illinois Increased Sales 20 Per Cent During Past Six Months.

During the first six months of the present year the total wattage of the electrical appliances sold by the Public Service Company of Northern Illinois was 20 per cent in excess of the score made in the same period of 1917. Expressed in terms of money, the excess of the 1918 half-year term was also 20 per cent above the 1917 figures.

In the list of appliances, electrical irons led by a wide margin. More than 2500 of these were sold. Altogether the iron is easily the most widely distributed of electrical appliances, and although the number of sales named is considerable for any electrical appliance, it has been figured out in recent systematic investigations that the field of the iron is in the greatest part a virgin one. In fact, it has been ascertained that 8,700,000 houses in the country have been wired for electricity and about 4,100,000 irons have been sold.

In point of numbers sold vacuum cleaners and washing machines each rank after irons with portable lamps next. About the same number of sewing machine motors and heating pads were sold, and considerable more of each than in the period of 1917, with which comparison is made. Electric grills likewise showed an increased sale, and also curling irons, fashion having made this latter implement of great service.

SMELTING PLANT AT GREAT FALLS WILL INCREASE ITS ELECTRIC POWER LOAD.

Electric Furnaces for Manganese Ores, Copper Rolling Mills and Zinc Melting Furnace Are New Features Requiring Electric Power.

A number of interesting installations being made by the Anaconda Copper Company, in its smelting plant, at Great Falls, Montana, will result in a considerable increase in its electric power load, which already amounts to 45,000 horsepower.

The most important improvement in this line consists of constructing and equipping five electric furnaces for reducing carbonate of manganese ores from the Butte district. The furnaces are being built of brick and are being lined with magnesite. They are the arc type, each furnace having three sets of carbons, each carbon being two feet diameter. The five units will require 15,000 kilowatts, at a voltage of 85, and will handle 250 tons of manganese ore per day that carries 35 per cent of that metal. The product will amount to about 90 tons per day, running 80 per cent manganese, that being a grade suitable for the steel works for which it is supplied. It is expected that these furnaces will be ready for operation by October 1.

Another new feature, of interest to the electrical industry, is the establishment in this plant of copper rolling mills for the production of copper rods, cables and trolley wires, which require about 2000 horsepower in electric energy. The mill capacity is 40 tons of copper rods and 100 tons of copper wire and cable per day. The new mill will be engaged for some time in executing a contract which the Anaconda Copper Company has for furnishing the trolley wires and other copper material required by the Chicago, Milwaukee & St. Paul Railway in electrifying that part of its main line extending from Tacoma and Seattle easterly to a point a few miles east of the Columbia River. The rolling mills use motors for its drawing benches, stranding machines, rolling mills and other purposes. Three of the motors have a capacity of 500 horsepower each. The contract with the Milwaukee railroad requires 7,000,000 pounds of copper.

There is to be installed a 200-ton electric zinc melting furnace, of the Bailey resistance type, that will require 1000 horsepower in electric energy. This furnace, which has been ordered, will be used solely for melting metallic zinc and for reducing the amount of dross therein, to put the metal in forms required for manufacturing uses. In the furnace operation the electric power will be delivered at 100 volts.

The electric energy required for all phases of the Anaconda Copper Company works is delivered at its transformers by the Montana Power Company.

RUTLAND UTILITY COMPANY OBTAINS INCREASED WATER POWER.

Arrangements have been completed through the War Industries Board for the use of the water stored in Bomoseen Lake. This lake has a storage capacity of approximately 700,000,000 cubic feet of water, which, drawn through the Carvers Falls plant of the Western Vermont Power & Light Company is equivalent to approximately 1,000,000 kilowatt-hours. This assures the company of a supply of power during the low water period.

The Hortonia Power Company is replacing the present wheels in its plant at Hortonville and will be able to furnish the Rutland Company with 1,000,000 kilowatt-hours for which contract was closed some eighteen months ago.

The above sources, with the power stored in Chittenden reservoir, assures the company of at least 9,000,000 to 10,000,000 kilowatt-hours.

TACOMA GAS COMPANY EMPLOYS WOMEN ON METER REPAIRS.

Since January the Tacoma Gas Company has been employing women in its meter repair department and they have proved themselves exceptionally efficient in this work. The general manager of the company says:

"They are doing the regular meter repair work, including complete repairs, except for the diaphragm work. They handle the regular stripping of meters, grinding of valves and the packing boxes, including the replacement of all the metal parts and soldering work, in a very efficient way. We started these women at $2.75 per day, the regular rate we paid men apprentices in the meter shop, and as they are able to handle all the work pertaining to meter repairs, have increased them to $3 per day.

"We are also employing two women meter readers."

NEW BUSINESS OF BYLLESBY PROPERTIES.

All Byllesby electric properties reporting for the week ended July 26 show the following new business gains (net): 317 customers with 344 kilowatts of lighting and 260 horsepower in motors. New business contracted for but not yet connected includes 939 customers with 315 kilowatts of lighting and 1763 horsepower in motors. Electric energy output shows an increase of 16.7 per cent over the corresponding week a year ago.

Operating

Control Details of Automatic Hydroelectric Plant—Making Pole Raising Safer—Determining Condition of Poles

CONTROL DETAILS OF AUTOMATIC HYDROELECTRIC PLANT.

Features and Sequence of Control of Cedar Rapids Station.

The accompanying wiring diagram is that of the automatic hydroelectric plant of the Iowa Railway & Light Company, at Cedar Rapids, and described before the annual convention of the A. I. E. E.

The waterwheel gates of the three turbines driving the 400-kw. generators are not supplied with the usual hydraulic governor; instead, the opening and closing of the gates is obtained by a 5-hp. induction motor through reduction gearing. Twenty-five seconds is required for the gates to completely open, starting from rest in the closed position. A solenoid brake which releases when voltage is applied to the motor prevents overshooting. A contact-making device operating lamps on the benchboard at the Sixth Street station shows the exact amount of opening of each gate.

The correct sequence of operations in the control of each generator is obtained by properly placed segments on the drum of a controller which is driven by a single-phase 1-hp. repulsion-type motor. This controller definitely determines the proper time spacing between the different steps of starting the unit and connecting its generator to the bus.

The exciter sets are controlled by two oil-immersed contactors, also a double-throw, triple-pole switch, to connect either one or the other of the exciters to the exciter bus. The middle blade of this switch selects the proper contactor for starting the exciter set which is connected to the excitation bus. A small induction motor carries a centrifugal device on the end of the shaft for shutting down the plant, thereby preventing runaway in case system frequency rises to 64 cycles.

The units have individual float switches set for slightly different levels. If the water rises to a certain level it closes the float switch of the first unit, and that machine is started and put into service. If the flow of the river is such that the water continues to rise the second float switch closes, starting the second machine. The third switch is set still higher. The machines are shut down in the reverse order to the above as the water level falls.

The sequence of operation of each generator is as follows: The closing of the float switch or the proper remote-control button in the steam station starts the exciter set (provided it has not already been started with another generator) and opens the waterwheel gate. When the generator comes up nearly to synchronism it is connected to the bus without field but in series with a 20 per cent reactance. A weak field is then applied, pulling the machine into synchronism. The field is then strengthened to full field, the reactance short-circuited and the water-wheel gates opened to carry full load on the unit.

The generators operate with a fixed excitation adjusted for normal full-load value. If the water level is so low that with full gate opening normal load cannot be obtained, the generator, due to its high excitation, takes care of part of the wattless kilovolt-amperes of the system. The speed and voltage are, of course, determined by the steam turbine generators.

Details of Operation.

Two small transformers connect to the 2300-volt bus, stepping down to 220 volts, two-phase, for an operating bus. One phase from this bus through the double pole switch No. 29 controlls the contactors of each generator equipment. An emergency throwover switch between these transformers and the 220-volt bus, in case of failure of voltage on either phase, is thrown over to a separate source of power brought in from the other station.

Closing float switch No. 1, or the control button in the steam station, closes contactor No. 4 provided that control button No. 2 is also closed. This energizes controller segment No. 14. Segment No. 17 completes a circuit through the coil of contactor No. 6, starting the motor driving the drum controller. A circuit is also made at No. 16 through the contacts of relay No. 41, which is now energized, through the coil of the contactor No. 5, through the contacts of relay *E*, the inverse-time relays No. 5 and the thermostat relay No. 10. The thermostat relay is connected across one phase of the control circuit and is, of course, picked up if all the thermostats are closed, indicating that there is no overheating. Relay *E* is connected across the other phase and is picked up unless the frequency of the bus exceeds 64 cycles. Contactor No. 5 now closes energizing segment No. 1 of the controller. A circuit is now made through segment No. 2 picking up relay No. 42. Either one or the other of the two exciter sets can be started, depending on whether the switch *K* is closed up or down. The picking up of relay No. 42 completes the circuit through switches No. 28, which are closed, through the coil of contactor *G*, throwing full 2300 volts on the stator of the induction motor.

Contactor No. 43, with its coil across the exciter armature, short circuits the field rheostat until the exciter voltage is built up to 75 or 80 volts. The set comes up to speed and voltage up to normal very quickly and the direct-current voltage relay No. 11 picks up. The holding circuit of contactor No. 5 now closes through relay No. 11, the lower interlock of contactor No. 5 and through segment No. 15-A, so that No. 5 stays closed after No. 16 has left contact unless the exciter voltage drops.

Meanwhile the controller has been rotating and a circuit is made through finger No. 3 to the middle of point of relay No. 20. As the generator is not connected to the line, no current flows in contact-making ammeter No. 21 and its contacts are closed in the up position. If No. 1 button in the steam station is closed the left-hand side of relay No. 20 picks up. The

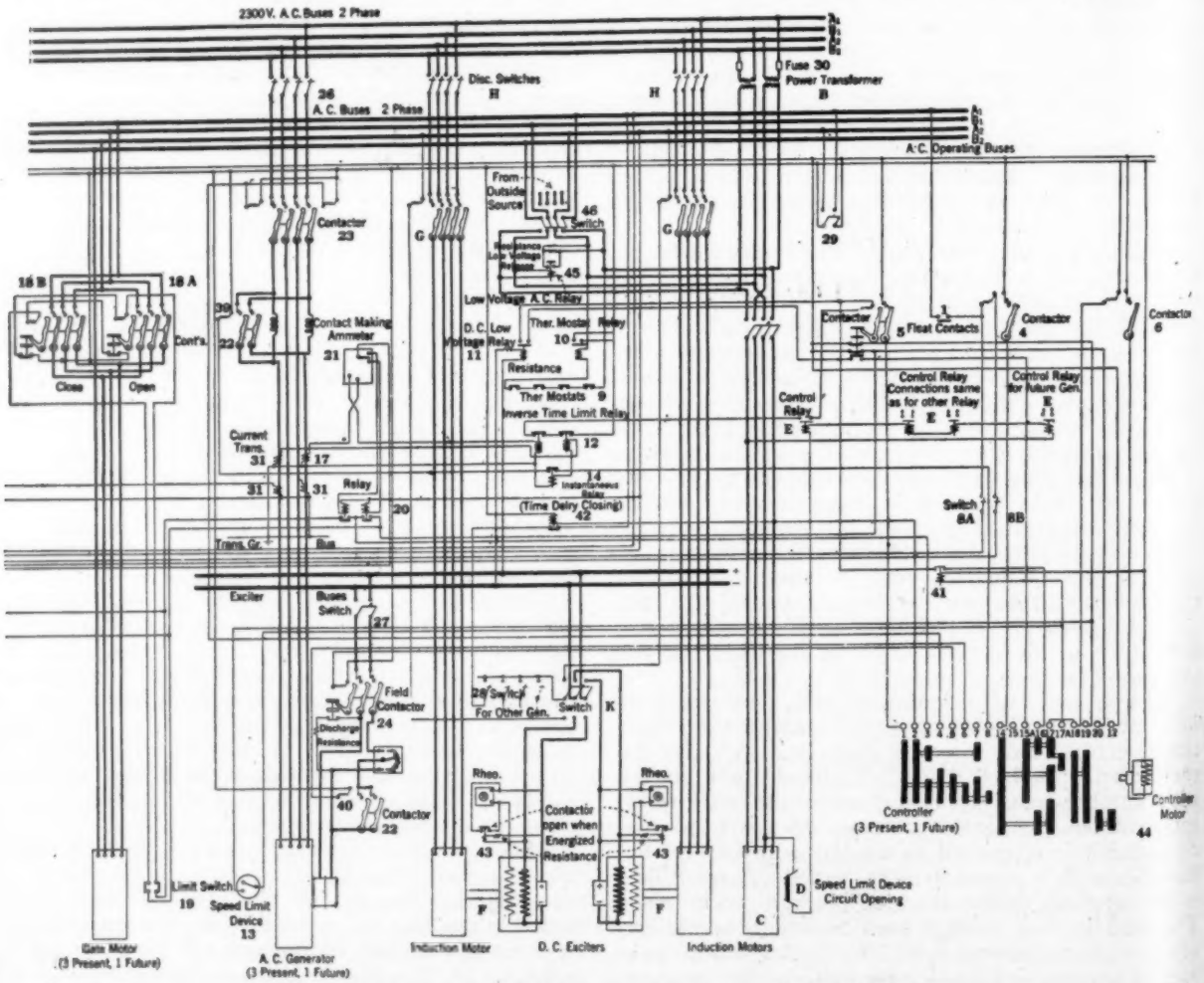
energizing of finger No. 3, therefore, completes the circuit through the coil of contactor No. 18-A, which starts the gate motor in the proper direction for opening the gate of the waterwheel. Finger No. 3 is in contact a definite length of time which is sufficient to give a gate opening on the waterwheel of such amount that the no-load constant speed would be about 65 or 70 r. p. m.

Contact No. 6 held closed by finger No. 17 has been energizing the controller motor. This finger next comes to the break in its segment and the controller stops in this position, waiting for the generator to come up to speed. On each generator there is a centrifugal device No. 13, set to close at about 55 r. p. m., that is, 5 r. p. m. below normal. When this switch closes, a connection is made from finger No. 17-A to No. 19 and through the controller to No. 18 to contactor No. 6, starting the controller again.

The gate opening is such that the generator is slowly rising in speed, so that when segment No. 4 on the controller comes into contact, the speed is approximately normal. Contactor No. 23 connecting the generator to the bus without field and with a reactance in series then closes. Finger No. 5 next closes the field contactor No. 24, putting a weak field on the generator and pulling it into synchronism. Finger No. 6 then closes contactor No. 40, short-circuiting part of field rheostat, thus strengthening the field to full normal value. Finger No. 8 closes contactor No. 39, short-circuiting the reactance, while finger No. 3 has come into contact again and contact-making ammeter No. 21 opens the gate until the current of the generator is up to normal value.

The generator is now properly connected to the bus and carrying full load. Finger No. 17 comes to the second break in its segment and controller stops in the full running position.

The equipment can be shut down in several different ways. If the pond level falls, due to the fact that the demand for water is greater than the flow of the river float switch No. 1 opens. If it is desired that the steam station shut down and start from the water level, button No. 4 will be open and the opening of both this button and the float switch will trip contactor No. 4. If it is desired to shut down any generator and prevent its starting again, button No. 2 in the steam station should be opened, thus also tripping contactor No. 4, de-energizing segment No. 14 of the controller, when contactor No. 5 drops out, de-energizing segment No. 1 and dropping out all other contactors, connecting the machine to the bus. When contactor No. 5 drops out, the upper interlock makes a circuit through segments Nos. 19 and 18, picking up contactor No. 6 and running the controller to the off position. The middle interlock of contactor No. 5 is also closed, energizing contactor No. 18-B, and closing the waterwheel gate. As the controller rotates to the off position fingers No. 20 and 21 are bridged. These contactors are in parallel with the middle interlock on contactor No. 5 to give additional contact surface. A



Wiring Diagram of Automatic Hydroelectric Plant at Cedar Rapids, Ia.

1-hp. two-phase motor driving a speed-limit device which opens when the speed exceeds 64 cycles is connected to the operating bus. If the hydroelectric plant becomes separated from the steam station, the generators will, of course, speed up, increasing the frequency of the bus, tripping the speed limit device *D*, dropping out the four relays *E*, which in turn drop contactors No. 5 on all generators. This drops out all other contactors, and as the bus voltage then drops to zero the automatic throw-over switch No. 46 connects a separate source of power to the control bus, thus furnishing energy for closing the gates of the water-wheels to shut down. The wiring is so arranged that the relays *E* and No. 10 are connected outside this throw-over switch so that the generators cannot be started until the main cable between the station is re-energized.

If for any reason the generators have gone above speed and the main tie cable has been re-energized, relay No. 41, which is picked up whenever the centrifugal switch on the generator is closed, prevents the picking up of contactor No. 5, until the speed of the generator has dropped to a value somewhat below normal. The generator is prevented from being thrown on the line when running at a considerable speed above normal.

The above description covering one generator applies equally to the other generators. Each controller has a relay No. 42 so that the exciter can be started from any controller; that is, any generator can be started first and its controller starts the exciter.

The steam station is equipped with control buttons so that, if desired, the gate opening, and therefore the load on the hydroelectric generators, can be controlled from that place. The ammeter control is cut out by opening button No. 1 in the steam station.

RAISING POLES MORE EASILY AND SAFELY.

Method in Vogue by Southern California Edison Company.

Raising and setting poles for distributing circuits and transmission lines is usually associated with large gangs of men with pike poles and other paraphernalia for lifting the pole, holding it and anchoring it in place until properly located and the pole hole is filled and tamped down. Pole setting has assumed rather a different aspect since linemen's gangs have been depleted by the drain of the war and industry. Men are hard to get and as hard to keep on the job. This being the case, effort has been made everywhere to simplify work and make it as safe as possible.

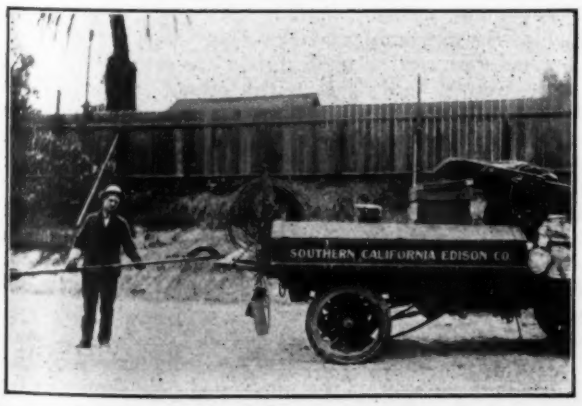


Fig. 1.—Folding Pole Support Folded for Shipment.

The Southern California Edison Company uses a folding pole support for pole raising and lowering that has been found to make the work safer, one requiring less exertion and fewer men for pole handling. The pole support is shown folded up ready for being placed in the lineman's wagon in Fig. 1 and in use in Fig. 2. It is claimed that the use of this support is appreciated by the men, because permitting poles to be handled with less effort, and at the same time safeguarding against certain types of accidents that may be encountered when pike poles are used. As the pole support

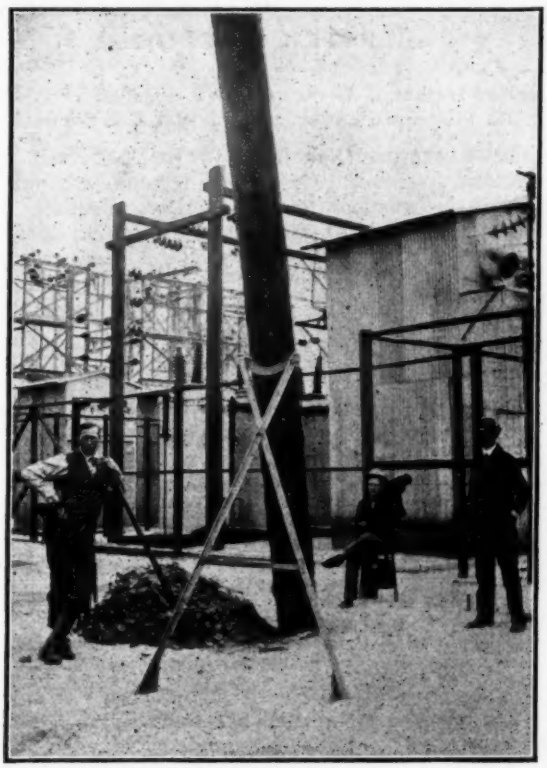


Fig. 2.—Bush Folding Pole Support in Use Outside Southern California Edison Company Substation.

folds up it takes up very little space in the truck. Being light, it is well adapted for transportation.

DETERMINING CONDITION OF POLES.

It is advisable for linemen to determine the condition of wooden poles before climbing them whenever there is the possibility of the poles being in inferior condition due to long service, mechanical injury, lack of guying, etc. If this is not done a pole may be unable to bear the weight of a lineman, toppling over, with serious if not fatal results to the lineman.

A pole can be tested near the ground line for decay very simply by the use of a bar or screwdriver. The center of a pole may be "sounded" for decay by rapping with a block of wood or heavy tool.

The importance of keeping tree branches and twigs clear of series lighting circuits has made itself more apparent since the series tungsten lamp came into wide usage. Grounds and short-circuits occurring on arc-lamp circuits caused little trouble other than resulting in flickering, absence of light, opening of circuit breakers, or even burnt-off wires. With the tungsten lamps, however, short-circuits and grounds may cause the lamps to burn out with short life.

Contracting-Construction

Identification of Wire Insulation Deferred—Finding Height of Pole—Other Kinks—Among the Contractors

SUSPENSION OF A RULE OF NATIONAL ELECTRICAL CODE.

Identified Insulating Covering of Wires Called for in Rule 26a Suspended on Account of War Conditions.

The Executive Committee of the National Fire Protection Association, upon the recommendation of the Electrical Committee of that organization, has voted to suspend indefinitely the enforcement of Rule 26*a* of the National Electrical Code, edition of 1918, insofar as this rule requires the marking of wires and cables by manufacturers to facilitate the identification of the polarity of conductors.

This rule, which is new in the 1918 Code, was adopted last fall as a part of the report of the subcommittee on grounding and as printed in the Code calls for enforcement after January 1, 1919. It reads as follows:

"The neutral conductor on all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering, readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation and properly connected at all fittings to properly identified terminals in order to preserve its continuity.

"When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in Nos. 15 and 15A."

The purpose of the rule was to facilitate the identification of the neutral or grounded wire of a circuit in order that the proper grounding might be secured in all cases with less liability to mistakes and as a part of the general tendency noticeable in the development of electric practice at the present time to extend the grounding of circuits and devote more attention to this and similar requirements especially from the viewpoint of safety against accident to persons.

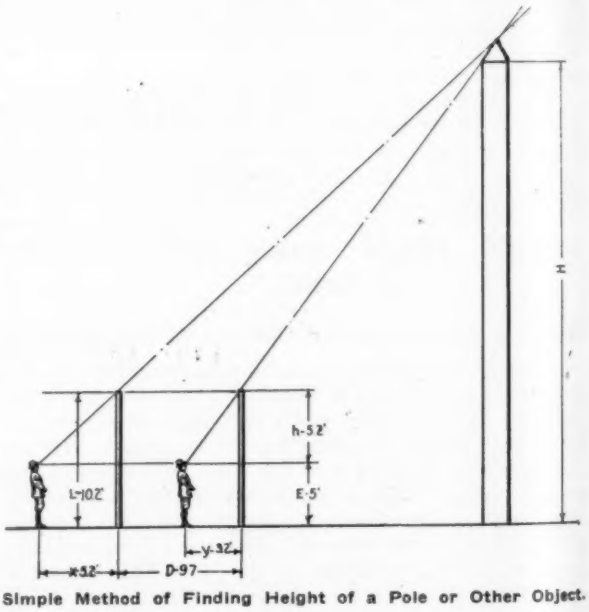
The recommendation for this action in suspending this rule came from the Underwriters' Laboratories' Industries Conference on Rubber-Covered Wires after a careful investigation of the present situation had been made among wire manufacturers and others which developed the opinion that the present time under war conditions was unfavorable for the change involved in view of the considerable increase in equipment at wire factories already pressed to the limit to provide the products necessary for Government and other uses and the probable added expenses which would result in carrying stocks, in transportation and in distribution of wires and cables.

The idea has been suggested that inspection departments, contractors and others desiring to secure the result aimed at in the rule in question might arrange for a marking of conductors and terminals at outlets as they are installed by means of painting or other distinguishing marking. It would appear that if this were done carefully and systematically most, if not all, of the desirable results aimed at could be secured in this manner.

SIMPLE METHOD OF DETERMINING HEIGHT OF AN OBJECT.

By L. A. Ring.

There are several methods of finding the height of any object which cannot be measured directly or conveniently. One of them which is applied readily and which is relatively accurate is explained in the accompanying sketch. The only instruments which are required are a couple of rods and a tape line, or two-foot rule. The observations are made most conveniently by two men, but one person can make them. Assume that it is desired to find the height H of the pole. A convenient distance, D, is measured off along level ground. Then a staff is set up on the ground at each of the extremities of D.



Simple Method of Finding Height of a Pole or Other Object.

One staff can be made to do, by setting it first at one extremity and then at the other. Ascertain the distance y from the staff to a point where the observer stands, so that his line of sight with one eye open, the other closed, just cuts the top of the staff and the top of the object. Then a similar observation is made at a distance x from the other staff. Subtract the height E of the eye above ground from the length of the staff L, to find h. This observation being made, the following formula, which is based on the laws of similar triangles, can be used:

$$H = [(D \times h) \div (x - y)] + h + E.$$

As an example, consider the following problem: What is the height of the unstepped pole shown in the illustration? The observed measurements were as

follows: $D = 9.7$ ft.; $E = 5$ ft.; $h = 5.2$ ft.; $x = 5.2$ ft.; and $y = 3.2$ ft. Using these values in the formula given, we have:

$$H = [(9.7 \times 5.2) \div (5.2 - 3.2)] + 5.2 + 5$$
$$= [50.4 \div 2] + 10.2$$
$$= 25.2 + 10.2$$
$$= 35.4 \text{ feet.}$$

TRUEING UP CARBON BRUSHES.

By James Burns.

Carbon brushes on motors or generators, when used very much, should, as a general rule, be smoothed off quite often, as nonuniformity of the common carbon brush causes the soft spots to wear away much more quickly, which means much sparking and a rough commutator if left in that condition very long. Strips of sandpaper the width of the brushes are mostly used for smoothing up the brushes and trouble is often experienced where narrow strips have to be used, because they will tear very easily. This often discourages some and the brushes are not trued up as often as they might be. If a strip of good cheesecloth is cut the same length and width as the sandpaper used and put under the sandpaper and both moved back and forth together it will be found that a much quicker and better job can be done. Of course, the cheesecloth surfaces should be kept flat against commutator so that the sandpaper will not round off the edges (toe and heel especially) of the brush.

FIXTURES ON PLASTER BOARD.

By R. A. Jeffers.

I often find places where I must install fixtures but where there is no solid wall or ceiling, plaster board or its equivalent being used to make the partition or false ceiling. It is practically impossible to fasten fixtures to any such board directly, but it may be done with the aid of wooden blocks about 6 by 6 in., 8 by 8 or even larger, depending on the size and weight of the fixture. Place the block on the opposite side of the plaster board where the fixture is to go and fasten the crowfoot by screwing through the plaster board into the wood block. The latter gives a large surface of contact against the plaster board and makes quite a solid fastening for the crowfoot for the fixture and at the same time a neat job.

The above scheme will also come in very handy around the electrical or any other store where beaver and other boards are used as backgrounds for displays or to which to fasten brackets or other fixtures.

EMERGENCY REPAIR FOR LOOSE KEYS.

By A. Gemmell.

In cases where there are loose keys on pulleys, gears, couplings, etc., of motors or other machinery, and no new ones can be had right away, if the following method is put into effect serious delay or chewed-up keyways (which sometimes means a new gear or coupling) will be avoided.

A slot for a wedge is cut in the outer end of the key with a hacksaw. It is not necessary to make the slot more than one-third the length of the key. The wedge should have only a very slight taper to it. This will be found a simple, quick and practical repair that plant and shop electricians should be familiar with.

AMONG THE CONTRACTORS.

W. P. Richardson, of Jacksonville, Fla., has been awarded a contract for installing an electric lighting system in the section of the city now being developed for shipyards.

The Simes Company, 22 West 15th Street, New York City, was awarded the contract (at $7694) for furnishing and installing lighting fixtures in the United States Post Office at Portland, Ore.

The F. E. Newberry Electric Company's Los Angeles (Cal.) office has been awarded a contract for electrical work in connection with the new balloon instruction camp being established at Arcadia, Cal., by the Government.

Contract has been awarded by the United States Government, Navy Department, for the installation of the proposed new local underground conduit system at Chatham, Mass. The Hixon Electric Company, Boston, Mass., is the contractor.

In connection with the erection of the large new plant of the Kenyon Company, 754 Pacific Street, Brooklyn, N. Y., to cost in the neighborhood of $375,000, the contract for electrical work has been awarded to Charles E. Knox, of 101 Park Avenue, New York City.

The State Supply Company, Helena, Mont., is putting through the contract for wiring of St. Vincent's Hospital, Billings, Mont., and for installing the motors for elevators and ventilators, and putting in the silent signal system. The contract amounts to between $12,500 and $13,000.

The Pierce Electric Company, 215 West Randolph Street, Chicago, has been awarded the contract for all of the electrical work in the large new plant of the Griess-Pfleger Tanning Company, at Waukegan, Ill. Included in this is a complete power plant, underground distribution system and complete wiring of all the buildings for light and power. Over $40,000 is involved in the electrical contract alone.

Among the numerous contracts recently executed by A. H. Cox & Company, Seattle, Wash., was the wiring for the large outdoor carnival held July 23 to 28 under the name "Seattle Girls' Victory Carnival." It included a large open air theater with special lighting effects for the stage, obtained chiefly by flood lights and spotlights. The numerous paths and roads were lighted by festoons. This installation showed the versatility of the Cox organization, which has already become well known for the variety of industrial wiring installations it has completed. The company reports a large business in this line during the present year.

Salisbury Electric Company, Ltd., has moved its offices from 49 Wellington Street East, to 615 Yonge Street, Toronto, Ont., Canada. This firm does an extensive business in contracting and also manufactures electric radiators, water heaters, automobile heaters, as well as a complete line of silk lamp shades, floor and table lamps. In its merchandising section, the firm carries an extensive stock of washing machines, vacuum cleaners, and all kinds of high-grade electrical supplies. The rapid growth of the company's business necessitated obtaining larger quarters and in the new premises the company is enabled to combine its offices, salesroom and manufacturing business under one roof. This enterprising company has adopted as its slogan "Service All the Time."

Dealer-Storekeeper

Concrete Suggestions for Successful Operation of Electrical Store — Dealer Opens New Field for Sale of Fixtures

NEW IDEAS IN AN ELECTRIC SERVICE STATION.

Cowie Electric Company Maintains Completely Equipped Plant for Caring for Batteries and Electrical Auto Equipment.

Moving the battery service from the curbing into the building has taken a long time, but it is coming surely, if not already accomplished. In the case of the Cowie Electric Company in Kansas City, Mo., and Wichita, Kan., nothing has been overlooked in the erection of a battery service station by this company to make the owner satisfied with the service he gets when anything electrical about his automobile is in need of repair.

In a new building erected on automobile row in Kansas City, Mr. Cowie, who began working with phonograph batteries in Kansas City 20 years ago, attempted to make use of every foot of room to the best advantage and give both workmen and customers adequate facilities for both quick and satisfactory service. The building is 50 by 140 feet and has a front automobile entrance from the McGee Trafficway. The offices also front on the trafficway on the first floor.

Inside the entrance, automobiles may be parked for temporary work or for the exchange of batteries. Troublemen well qualified to detect trouble in any department of the automobile are ready to wait upon the customer. If a battery is run down or in need of repair or renewal, the old one is taken to the basement battery department and a renter placed on the car. If a generator or magneto is at fault, it is taken to one of the two work balconies that extend over the ground floor parking space. In these balconies are the machines of unique design that enable workmen to make speed and at the same time give thoroughness to every electrical test.

A wonderful degree of efficiency and economy has been obtained in the jobs whereby a minimum of equipment is necessary to handle any type of motor electrical equipment which may be brought in for repair. The most revolutionary of this equipment is the use of universal holders in the various departments for working on and testing motors, generators, magnetos, etc. The same principle is employed in each of these departments—the vise which holds the item to be worked on is set on a slide that can be moved back and forth in a grooved seat; an armed hinge on the power shaft of the work table contains a belt operated from the shaft and turning a chuck at the end of the arm which engages the shaft of the item being worked on.

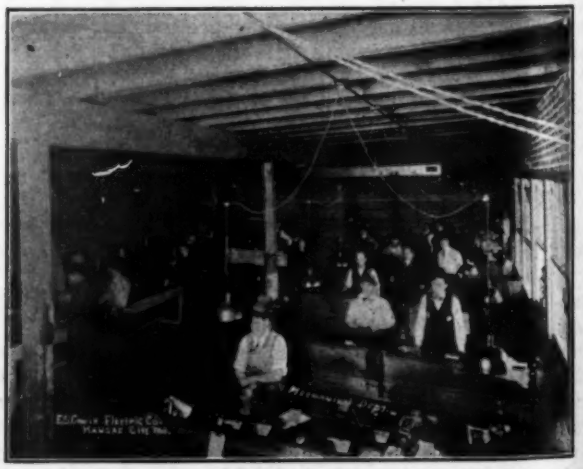
There are many refinements in each feature of the arrangement—for instance, the hinged end of the chuck arm is served by compression springs so that when the chuck grasps the shaft of the item worked on there is no pressure on the shaft from the weight of the chuck arm.

The universality of the arrangement for handling any type of equipment may be illustrated by the device in the department for testing magnetos. The application of the principle mentioned above is varied slightly to meet the conditions. A steel table three inches wide and two feet long standing about four inches from the surface of the work bench constitutes a universal holder ignition heads. There are three orifices in the surface of this little steel table and any type of ignition head will fit into one or another of these. Longitudinal on the table and midway in its height runs a shaft with three gears on it, one opposite each of the holes. The shaft is operated by the chuck and chuck arm above referred to.

On this same table opposite the same chuck arm is the vise in its grooved piece for holding the magnetos to be tested.

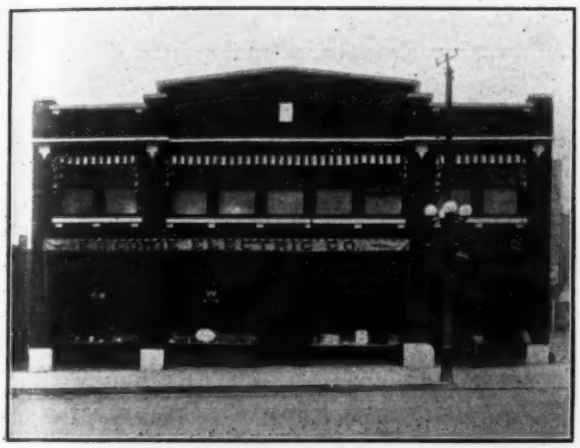
The universal holder and the universal drive arm

Battery Department of Cowie Electric Company.



Mechanical Department of Cowie Service Station.

are only slightly modified for the department for testing generators and motors. In this department a novel use of the motor to operate the test has been made to secure variable speed and reverse the drive shaft without changing the speed of the motor. The motor is set up with its shaft perpendicular to the edge of the work bench. To the inner end of the shaft is attached a ten-inch friction disc. The drive shaft for the chuck arm is provided with a friction wheel which is operated by the friction disc. By an ingenious arrangement the workman, by turning a small wheel convenient to his hand, can throw the friction wheel from high speed forward to low speed, across the center of the friction disc into low speed or high speed reverse, the action, of course, being transmitted to the chuck on the end of the chuck arm and to the motor and generator being tested.



Cowie Electric Company's Store and Service Station.

Mr. Cowie has installed a high-tension winding department, the first, it is said, to be installed in the west. While the Cowie establishment keeps in stock coils for the magnetos made by companies it represents, a department is maintained for obsolete makes and for emergencies. The equipment for winding the coils is operated by a small motor. The winder starts or reverses from a foot control. There is a small wooden wheel on the end of the shaft for the operator's use in slow rotation for applying glue and paper.

Every department of the shop has many original devices for expediting work. For instance, in the armature winding department there are iron frames into which the armatures may be set. The frames are secured to a shaft and turned, the wires being guided to their proper positions.

In the basement is a department for repairing, testing and making batteries. Indeed, practically any of the batteries can be made in this place, and this is done every day. One instance of the company's resourcefulness, in the face of hampered express shipment, is that it moulds its own lugs for battery terminals.

In every department of the Cowie shop the prime consideration has been to get the work done well. In nearly every department one of the net results has been the economical production of the work. That the service has been welcomed by the west is evident by the widespread shipments of items to Kansas City for repairs and the many orders for batteries and battery parts of certain types that are received almost every day.

CASHING IN ON THE "FOR SALE" SIGN.

How an Electrical Dealer Opened Up an Entirely New Field for the Sale of Fixtures.

By J. S. Older.

The average dealer in electric lighting fixtures would not think much of his chances of selling new fixtures for a house where the "For Sale" sign is prominently displayed.

But this war is bringing about all sorts of changes and at least one dealer is making a specialty of selling electric lighting fixtures to property owners who are offering their property for sale.

A Des Moines electrical dealer was called to a residence to renew a few old and shabby sockets. While doing this work, the property owner volunteered that he was trying to sell the house—and that the first man who looked at the place called attention to the old and shabby sockets, at the same time suggesting that in all probability the putting in of the electric light was a cheap job.

In normal times this dealer would not have thought much of a remark of this kind, but when business is slow and rent is to be paid every month, suggestions for additional business are not easily lost.

After repairing the sockets, the dealer suggested that so far as appearances were concerned, a few additional electric light fixtures would greatly improve the appearance of the entire home—and the cost would be comparatively low.

After talking over the matter for half an hour, the dealer made a few definite suggestions for new fixtures. A new inverted globe for the hall light, a new fixture for the porch, with the house number on the fixture. Fancy shades for every individual lamp, chain sockets instead of the ordinary old style sockets and similar changes.

These changes all told amounted to about $75. When mentioning the approximate cost, the dealer at the same time suggested that these changes would enable the property owner to get at least $250 more for the place, than if sold without these simple and inexpensive improvements.

The dealer received the order for the new fixtures.

But this business was only a beginning of the business that came later on. The dealer soon discovered that the "For Sale" signs meant more to him than the mere fact that the house was for sale. It meant the possibility of additional business for him, new sales of fixtures, etc.

But personally soliciting this business was hard work. While trying to find some shorter method of reaching these property owners, he remembered that he had read an article in one of the electrical journals that told of the profitable business that resulted from the use of circular letters. If others could profit by the use of circular letters, so could he. But, thinking about it and actually writing a circular sales letter were two entirely different things. He found it extremely hard to write a satisfactory letter and it required more than two days work before he succeeded in writing a letter he thought good enough to mail out.

Letter That Secured the Business.

Here is the letter:

"You want to sell your home. You want to sell it at the highest possible price. If I can tell you how to increase the value of your property, are you willing to listen?

"I am in the electrical business. I sell electric lighting fixtures.

"I have always found that when a woman looks at a home with a view to buying, there is one thing she is always highly interested in.

"And that is the inside appearance of the home.

"I know of a single instance where $100 invested in additional electric lighting fixtures increased the value of the house by $500.

"Your fixtures may be everything that is desired. But, still, you may be able to make some very desirable improvements at a small cost.

"I am not asking that you change your present fixtures without serious thought. I am simply asking that you allow me to see the fixtures you now have in your home.

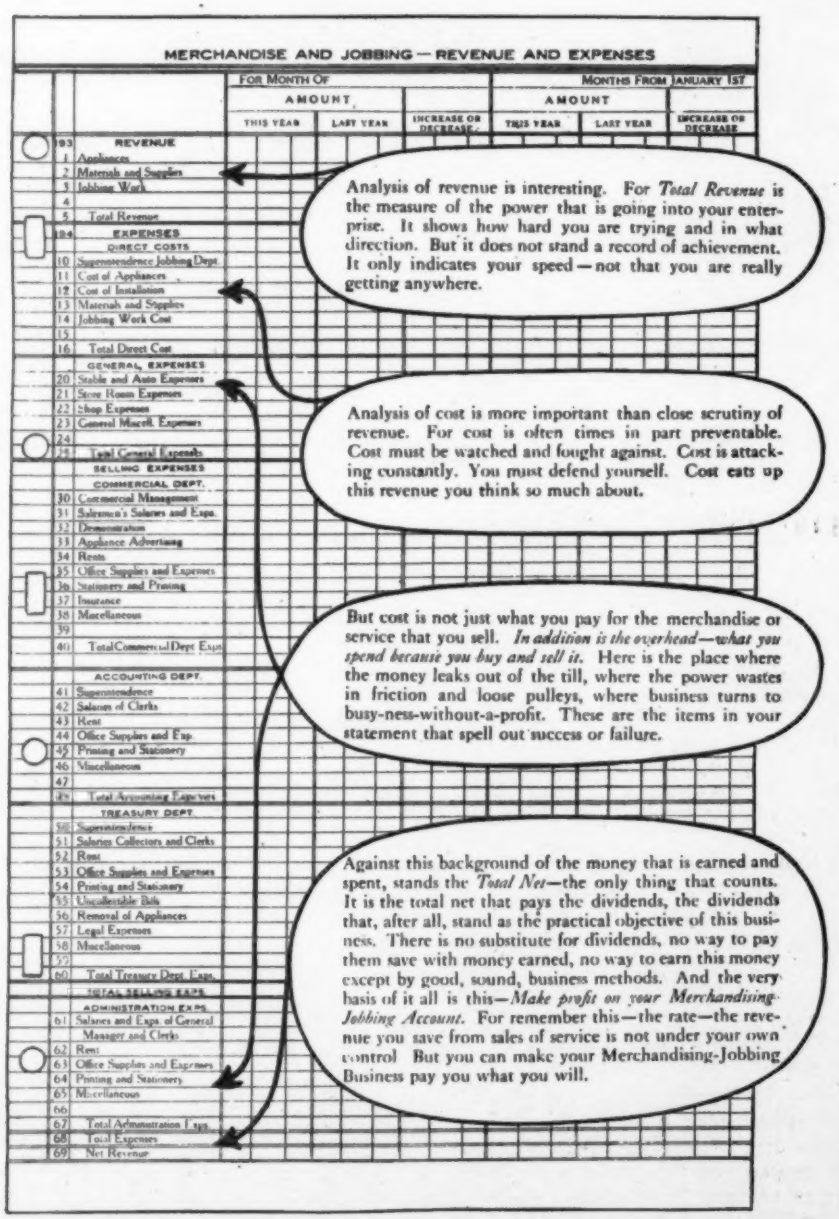
"If I can make suggestions for a change of fixtures, or for new fixtures that will greatly increase the attractiveness of your home, I know you will consider them. And you can then decide whether or not you think the change worth while.

"Allowing me to make these suggestions will not cost you a penny—and it will not place you under any obligations.

"But there is a possibility that it may result in mutual benefit.

"Do not stop to write me. Simply 'phone me. Tell me I have your permission to look over the electrical fixtures now in your home. That is all I ask. My 'phone number is. . . . "

This letter was mailed out to all property owners who advertised their homes for sale in the local papers. The letters did not produce results in every instance, but the business secured through these letters was more than enough to make the effort a highly profitable one.


MERCHANDISE AND JOBBING — REVENUE AND EXPENSES
FOR MONTH OF
MONTHS FROM JANUARY 1ST
AMOUNT
THIS YEAR
LAST YEAR
INCREASE OR DECREASE
REVENUE
Appliances
Materials and Supplies
Jobbing Work
Total Revenue
EXPENSES
DIRECT COSTS
Superintendence Jobbing Dept.
Cost of Appliances
Cost of Installation
Materials and Supplies
Jobbing Work Cost
Total Direct Cost
GENERAL EXPENSES
Stable and Auto Expenses
Store Room Expenses
Shop Expenses
General Miscell. Expenses
Total General Expenses
SELLING EXPENSES
COMMERCIAL DEPT.
Commercial Management
Salesmen's Salaries and Exps.
Demonstration
Appliance Advertising
Rents
Office Supplies and Expenses
Stationery and Printing
Insurance
Miscellaneous
Total Commercial Dept. Exps.
ACCOUNTING DEPT.
Superintendence
Salaries of Clerks
Rent
Office Supplies and Exp.
Printing and Stationery
Miscellaneous
Total Accounting Expenses
TREASURY DEPT.
Superintendence
Salaries Collectors and Clerks
Rent
Office Supplies and Expenses
Printing and Stationery
Uncollectible Bills
Removal of Appliances
Legal Expenses
Miscellaneous
Total Treasury Dept. Exps.
TOTAL SELLING EXPS.
ADMINISTRATION EXPS.
Salaries and Exps. of General Manager and Clerks
Rent
Office Supplies and Expenses
Printing and Stationery
Miscellaneous
Total Administration Exps.
Total Expenses
Net Revenue
Analysis of revenue is interesting. For Total Revenue is the measure of the power that is going into your enterprise. It shows how hard you are trying and in what direction. But it does not stand a record of achievement. It only indicates your speed—not that you are really getting anywhere.
Analysis of cost is more important than close scrutiny of revenue. For cost is often times in part preventable. Cost must be watched and fought against. Cost is attacking constantly. You must defend yourself. Cost eats up this revenue you think so much about.
But cost is not just what you pay for the merchandise or service that you sell. In addition is the overhead—what you spend because you buy and sell it. Here is the place where the money leaks out of the till, where the power wastes in friction and loose pulleys, where business turns to busy-ness-without-a-profit. These are the items in your statement that spell out success or failure.
Against this background of the money that is earned and spent, stands the Total Net—the only thing that counts. It is the total net that pays the dividends, the dividends that, after all, stand as the practical objective of this business. There is no substitute for dividends, no way to pay them save with money earned, no way to earn this money except by good, sound, business methods. And the very basis of it all is this—Make profit on your Merchandising-Jobbing Account. For remember this—the rate—the revenue you save from sales of service is not under your own control But you can make your Merchandising-Jobbing Business pay you what you will.

Does Your Revenue-Expense Account Withstand the Acid-Test?

APPLYING THE ACID TEST.

Points to Be Borne in Mind in Monthly Merchandising-Jobbing Statement.

The accompanying illustration shows the monthly statement sheet of a merchandising-jobber. The important items to be watched and studied are shown in a prominent way. This method of emphasizing the importance of scrutinizing accounts deserves attention of everyone, is one readily comprehended, whereas words might tend to befog the issue. This illustration is reproduced by courtesy of the *Gas & Electric News*.

It is expenses that require careful scrutiny, because in part preventable and because expenses eat up revenue, often changing profit to loss. But cost is not what is spent for merchandise or service sold. Overhead enters—what is spent because of buying and selling. It is here that money leaks out of the till and where business loses its profit.

Examine this revenue and expense sheet, for it tells the tale—of failure or success. And failures or success means loss or profit.

The most important feature of the chart is the emphasis laid on profit. To make a profit it is first necessary to know your costs and then make every transaction pay a reasonable profit above these costs. Under present conditions, when merchandising is becoming such an important activity, there is every incentive to modernize cost methods.

How To Successfully Operate an Electrical Store

Concrete Suggestions for Selecting Location and Arranging Interior—From a Paper Before National Association of Contractors and Dealers

By R. E. FLOWER

SOME time ago I heard an address on "The War and Salesmanship." At that time we were not as wideawake to the war as we are today. The trend of thought was that we needed to be sold on the war. It was felt that Uncle Sam needed an advertising manager to sell the war to the people of the United States. And the speaker stated that if he were Secretary Daniels, he would send one of our submarines out into New York harbor and blow the top off the Singer Building just to wake the country up to the seriousness of the thing.

Just about the same condition exists today with regard to the opportunities that the war is laying in the path of contractors and dealers in the matter of merchandising electrical appliances. Very few contractors are awake to the money-making possibilities of appliance departments or shops for the sale of labor-saving electrical appliances. Some of you, no doubt, have stores. I hope you have made them profitable places of business, but those of you who have done so are exceptions. More of you have lost money and along with the money your enthusiasm for the appliance end of the game. You are sleeping on the job—you are not apace with the times.

I venture to say that a number of you have seen younger fellows leave you or your central stations and open small specialty shops and make good and yet you have never changed your viewpoint. You have never absorbed the idea that you could do the job much better than they—you with your established places of business and reputation of long standing.

I was talking to a young man in Davenport, Iowa, who for years had been an appliance salesman for the electric light company. He left them some few months ago and went into the washer business. He told me that last month he sold 56 electric washing machines. And I believed his statement because I know of men in this city who have plugged along for years as salesmen or department heads in retail stores, who have opened small appliance shops and in two or three months built a business of $5000 to $6000 per month in washing machines and ironing machines alone. Many of you have seen the department and furniture stores put in electrical departments and have felt the weight of their competition.

These are the channels this business is swiftly drifting into and if you contractors and dealers do not awake soon the specialty men, department stores and furniture establishments will have it beyond your reach.

A man remarked to me just the other day that he would like to get into the appliance business, but he had made up his mind to wait until after the war and see what conditions were then. The appliance business, and by appliance business I mean the washing machine, ironing machine, cleaner, sewing machine and electric range business, was never better than it is today. Conditions—war conditions—have made it so.

Today the servant problem is a most perplexing one to the housewife. Washwomen and servants are almost impossible to secure. War work with its unheard of pay and wages is calling the working women into the factories and mills where they not only earn a man's wages, but are doing their bit in the winning of the war.

I honestly believe that we men in the electrical industry can be of great service to our country in teaching our housewives efficiency and economy in the management of their homes.

I do not believe in elaborate electrical stores. Our electric appliance shops of today should be on a war basis. They should be attractive, of course, but their attractiveness should assert itself in their simplicity. They should be trimmed of all the frills and fancies that often creep into them. I have known of electrical stores planned in the form of completely furnished bungalowes at great expense. In these well appointed cottages have been boudoirs, every detail of which were perfect from the overhanging French cretonne draperies to the four-poster bed, all done for the display of a baby's milk warmer, a heating pad, and possibly mi-lady's massage machine. What a waste of space and money on articles of little merchandising value because of their slow turnover. Stay on the ground floor with your electric store.

Make your electric shop a war-time electric shop. Give your most valuable space to the labor-saving electrical necessities that should be in every home. I don't mean to minimize the usefulness of the smaller appliances, but the washing machine, the electrically operated ironer, the sewing machine, the vacuum cleaner and the electric range or fireless cooker are the necessities of the day—the appliances that the successful merchants are selling.

Display windows are important factors and should be carefully planned. See that they are of sufficient size for actual demonstrations. If you have two small ones, rearrange your entrance and put in one large window—and then use it. The windows of any retail merchandising establishment in your town are sufficient testimony to their value. Change the displays often and don't forget that motion catches the eye and makes many a sale.

In arranging your interior display put the labor-saving appliances in the most prominent place where customers coming into your store must see them. Keep the mazda lamps and fuse plugs in the rear; people will find them no matter where they are.

And just a word about your appliance display. A washing machine in itself has little attraction for anyone. Place it before a pair of neat laundry trays. Put water and soap in it and keep it running. The creamy suds will attract everyone to it and elicit questions that will give the salesman his chance to get the name of the prospect.

The same is true of the ironing machine. Have it near the washer. Connect it up both for gas and electricity so that you can operate it on a minute's notice. At its side should be a clothes rack upon which are a number of articles neatly laundered and ironed. A boy's rompers, pajamas, houses dresses and aprons, a negligee shirt and like things convey to the mind better than you can tell that this machine will iron 85 per cent of an ordinary wash.

Then comes the vacuum cleaner. Display it on a table, using a piece of good carpet or rug for the demonstration. This gets the machine up in a position easy to handle and the salesman makes the demonstration more at ease.

The electric sewing machine has its place in every home. Put it on a neat stand with a chair provided so that a lady may sit down and operate it herself. She knows the drudgery of the foot-power machine and will appreciate in a minute the advantages of the electric machine.

These are self evident bits of good merchandising, but how many electric stores use them?

The salesman is your one big problem. Clerks can be had in any numbers, but it is going to take some serious, thoughtful work on your part to make salespeople of them. This one thing is probably the cause of more failures in the selling of electrical merchandise than any other.

The other day I went into the electrical department of one of our large house-furnishing stores and happened to stop by the washing machine. As I was looking at it, a clerk approached and said: "Are you interested in an electric washing machine?" I told him that I was slightly, and he said, "Let me tell you about this machine. Is is a great device. It washes clothes." "Fine," I said, "but where do you put them." 'Oh, inside this cylinder. It then revolves six and a half revolutions in this direction and then goes in the other direction six and a half revolutions. The machine is $125. Can't I send one out?" and he looked at me as though he expected me to shell out one hundred and twenty-five perfectly good simoleons at once and give him my address for delivery.

I told him I wanted to know more about the machine. How did it get the clothes clean? How long would it take to do a washing? How much would it cost for electricity to run it? And, honestly, he couldn't answer correctly a one of these simplest questions that any woman would have asked.

He didn't know that dirt in clothes was simply dust particles held together by a greasy binder and that the hot water and the free alkali in the soap dissolved the greasy binder and that the gentle flushing of water through the fabric caused by the tumbling of the clothes flushed away this dirt without wear or tear on the clothes. He didn't call to my attention that a woman always washes her dainty and valuable pieces of point lace after the same principle by dipping them up and down in a bowl of hot, soapy water and that she did so to save wear and tear. He didn't tell me that this saving in wear and tear would mean anything to the housewife or that it would mean anything to my pocketbook through making the clothes last four or five times as long. He evidently didn't know that you didn't wear sheets out sleeping on them or that table cloths didn't wear out from the pushing of dishes around on them, but that it was the old-fashioned washboard that did the trick. He wasn't aware that he was selling an electric servant almost human in its ability to clean clothes quickly and without the confusion and fatigue that usually accompanies wash day.

He never gave me one good reason why I should part with my $125 and accept in return the greatest labor, time and money-saving device man ever built for use in the home.

Your salespeople must be educated to sell labor-saving appliances for the service they will give. A man buys a typewriter or a dictaphone for the service it will render his business and for that alone. So it must be with women in the management of their homes. It is up to you dealers to make the housewife feel her responsibility for the management of her home efficiently and economically.

Salespeople must put some human interest into their business. They must sell themselves the need for these things in the home before their enthusiasm can become real enough to carry them far towards the achievement of success in selling electric appliances.

District or outside salesmen are not beneath your dignity, if carefully selected, and they play an important part in doing a large volume of business.

The real successful merchants are all employing outside men for house to house canvassing. This game is still one of education and only in this way can you reach all of the people in your community with your message. These men can be secured on a commission basis. It is being done with much success. A good salesman produces an average of 20 sales per month. He will establish a nice business for himself and you if he conscientiously follows up the business as he secures it. Every sale produces another and the thing soon becomes an endless chain affair growing steadily almost of its own accord when once well started.

The problem of advertising is one to be worked out to fit conditions. Some successful merchants, for instance, set aside so much per machine for advertising. That is, if the amount is $2 per machine, and if he sells 50 machines this month, he will spend $100 next month on that particular item.

Appliances such as washers and ironers must be demonstrated and they must be sold on deferred payments in order to do a volume of business. When sold on time a charge for carrying the paper should be made. Too many dealers sell these things on 10 or 12 months' time at the list price and then give a discount from the list price for cash. This is all wrong. Your margin of profit isn't sufficient to stand this. The list price is fair and should be the amount of money you receive. You cannot make a profit selling appliances for less than the list and you cannot sell them on a year's time at the list and make any money. You must make the customer pay for the use of your money and the expense and trouble he is putting you to in asking you to carry his account over a considerable period. Arrangements can be made with the banks in most any city to discount your papers on these accounts. Some manufacturers have even gone so far as to organize finance companies for this purpose and will buy your papers if you sell their product. It is quite important that you work out the details of financing appliance sales on deferred payments. The rush of business and the rapidity with which these sales ties up capital has been the cause of big worries and much embarrassment to many dealers.

In closing let me repeat that if the contractors and dealers of this country are to keep the electrical appliance business within their grasp and out of the hands of the little specialty shops and the big department stores they must organize at once appliance departments along sensible, easily adhered to merchandising principles, backed by capable, well-trained selling forces.

Electric Vehicles

Electric Vehicle Committe Report—Prospective Demands of Electrics in England—Intercity Traffic by Truck

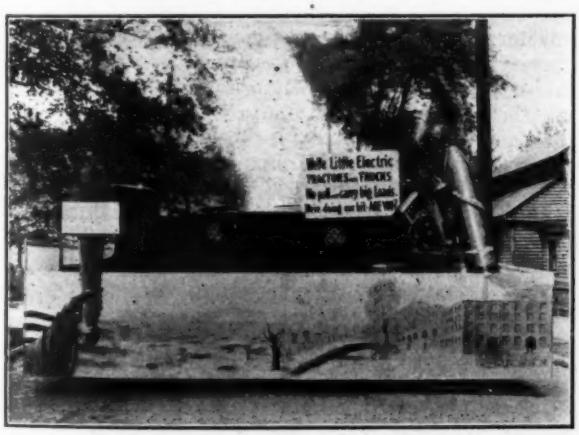
ECONOMY OF ELECTRIC TRUCKS.

In a recent instance a railroad in the West arranged for a demonstration of electric industrial trucks with six separate manufacturers, each of whom placed on trial for 90 days, without charge, one unit. At the end of 90 days the railroad purchased six trucks out of the savings effected during the free trial period. This comes pretty near being "something for nothing." It is needless to state that such free trial practice has been discarded just as same has been exterminated in other branches of the automobile industry, where, in the early days of the development, such generosity was grossly abused. However, this example illustrates effectively the economic advantages of such modern transportation.

Innumerable examples of electric industrial truck and tractor economic values can be cited all the way from a single truck more than saving its own cost in one year, to a saving of $54,000 in one plant through the use of nine units.

BAKER R. & L. INDUSTRIAL TRUCKS AND TRACTORS.

The Baker R. & L. (Rauch and Lang) Company, Cleveland, Ohio, manufacturers of Baker & Rauch and Lang electric passenger cars, and Owen Magnetic



Float of Baker R. & L. Company in Cleveland Parade, Showing Company's New Tractor.

passenger cars, somewhat recently developed a comprehensive line of electric industrial trucks and tractors to help meet the constantly growing demand for these highly economical and successful small utility members of the electric vehicle family.

Two types of the Baker R. & L. Company's electric industrial trucks and tractors carried on an electric commercial vehicle in the Loyalty Parade held in Cleveland, Ohio, July 4th, 1918, are shown in the accompanying illustration. One of the electric industrial trucks is shown carrying a large projectile.

Transportation units of this character are extensively employed in many munition factories in the United States and allied countries as well as being used in very large quantities in the more peaceful branches of industry, where they are enabling large numbers of men to be released for the sterner duties of war, and otherwise affecting necessary and important economies.

PROSPECTIVE DEMANDS FOR ELECTRIC VEHICLES IN ENGLAND.

A United States consular report of recent date, from Manchester, England, says:

The Electric Vehicle Committee of the Incorporated Municipal Electrical Association presented its report at the annual conference of the association, which was resumed in the city on June 21. An important phase of this report, which it is thought will be of interest to American manufacturers and exporters, concerned the progress that had been made in the adoption of electricity for commercial vehicles. A point emphasized was that the power was eminently suitable for short-distance haulage. The vehicles so fitted had established an excellent record for economy and reliability, and satisfactory progress was being made, having regard to the fact that under present conditions the machines could only be obtained for use for war work or work of supreme national importance. But for these war restrictions it would be safe to say there would be many hundreds more electric vehicles in use.

The report continues:

At last the knowledge that in actual commercial service the electric vehicle provides the cheapest means of transporting a given weight of goods a given distance in urban transport and delivery duty is diffusing far and wide in commercial circles, the proof of this being the increasing number of inquiries the committee is receiving as to how and where such vehicles can be obtained.

There were clear indications, it was further stated, that as soon as normal conditions returned there would be a great demand for electric vehicles.

The British automobile manufacturers, as well as the electrical manufacturers, are urgently requested to consider the question of design and methods of manufacture in order that they might be in a position to secure a good share of the orders that are expected will be readily obtainable when the trade situation improves.

There would seem to be an excellent prospect here for the sale of American electric vehicles in the near future, and it is suggested that manufacturers furnish the consulate with catalogs and specifications of electric vehicles for the use of its trade files in order that it may be in a position to assist in furthering the sale of the products as opportunity offers, and the opportunity is surely coming.

INTERCITY TRAFFIC BY MOTOR TRUCK.

Possibilities of Electric Truck for Long-Distance Haulage.

Railroad freight congestion and government embargoes have brought the motor truck very prominently before the business world as an important factor in intercity transportation. Motor trains and individual trucks are to be found on many important state highways carrying goods and making deliveries of a character that formerly were considered as belonging to the field of the railroads only.

In conjunction with this intercity traffic it has been discovered that many such hauls can be made economically with electric trucks; although electric trucks are usually considered as best for short haul, frequent-stop deliveries, and are so recommended, it has been found that under certain conditions the electric is capable of making fairly long hauls efficiently and economically.

In the eastern states—for instance, on the New York-Philadelphia turnpike—the unusually heavy traffic has so torn up the roadbeds that high speed is impracticable for heavily laden trucks. Thus the slower speed of the electric is often sufficient to cover distances with speed nearly as great if not equal to that of the gas truck. The trip between these cities has been conveniently made by electric trucks in a day. By charging batteries at Philadelphia, and recharging or changing at Trenton and Newark, sufficient power will be available for the entire trip.

A demonstration of this character was made some time ago with a Ward electric truck. Following is the record of a trip from Newark to Camden, the latter city being just across the river from Philadelphia: Left Newark, 6:30 a. m. Arrived at Trenton 11:50, a. m. In Trenton from 11:50 a. m. to 3:30 p. m. Arrived at Camden 8 p. m. Total mileage for the day, 110. Total time on road, 9 hours, 50 minutes. Total ampere-hours consumed, 137.

Because of the conservatism of most electric vehicle manufacturers, few if any of them would recommend their trucks for such service, even though they may believe the cars capable of making good. The above illustration, however, should be sufficient to suggest to many owners and prospective owners of electric trucks a field in which they might be used to advantage. Local conditions in each instance, however, must be a deciding factor.

THE WORK OF THE ELECTRIC VEHICLE COMMITTEE OF GREAT BRITAIN.

Although it is some little time since a report was issued dealing with the work of the committee, it must not be inferred thereby that the latter has ceased its activities. From the beginning of July, 1917, up to date, there have been five meetings of the committee, including sub-committees. The committee's efforts have been mainly directed to negotiations with government departments with a view to facilitating the extended use of commercial electric vehicles by an increase in home construction and a modification of import restrictions. The committee's efforts have not been unfruitful, but it is hoped that some further concessions may be obtained in the future, having in view the beneficial effect that the extended use of electrics would have in the matter of conserving grain and petrol supplies. It may be mentioned that the maintenance of all electric vehicles in service for utility and national work is strongly supported by His Majesty's Petroleum Executive on grounds of petrol economy.

The committee has been in close consultation with the Ministry of Munitions as to fuel economy and upon the question of the allocation of lead for lead-plate batteries. In view of the great demand for lead for war purposes, the committee has obtained a promise from the munitions overseas transport department to allot shipping space up to a total of six tons per week for the import from the United States of America of lead battery plates for electric vehicles. It was at first proposed that battery plates should be brought over and allocated through a firm of accountants acting on behalf of the Electric Vehicle Committee, but a consideration of the question by a special sub-committee led to a decision that it would be preferable to let the battery and vehicle makers apply, with the support of the committee, within the approved weekly limit of weight, to the respective Government departments concerned in import and shipping questions in respect of any batteries that may be required.

In July the committee was requested by the mechanical transport department of the Ministry of Munitions to co-operate in a scheme, proposed by the Director of Mechanical Transport, for getting more electric vehicles put into service with a view to saving gasoline, and a concomitant to this scheme was a proposal to provide facilities for the building of electric vehicles in quantities by certain British firms, and the import of vehicles from the U. S. A. The committee met in conference with the director at the ministry and discussed his proposals in detail. At the request of the department, and in connection with the scheme, the committee collected information from local authorities as to motor vehicles in use and those on order and generally went to a great deal of trouble in the matter. Owing, it is understood, to the increasing stringency of the steel position for war purposes, the contemplated scheme did not admit of adoption.

The committee has from the first hoped for the harmonious co-operation of motor traders and central-station organizations in promoting and facilitating the adoption and use of the electric vehicle. In some quarters there have been signs of opposition on the part of the motor traders to central-station authorities taking up the care and charging of electric vehicles, but this is proved to be due to a misunderstanding of the position. Now that the motor manufacturers and motor traders are represented on the committee, it is hoped to remove, with resulting harmonious co-operation between all interests. To this end a joint meeting is being arranged of the Council of the Motor Trade Association and the Electric Vehicle Committee.

SERVICES OF DOHERTY CADETS IN DEMAND.

Some interesting figures regarding the Doherty "cadet" engineers have been compiled by R. G. Griswold, chief technologist of the Doherty Organization. For instance, from 1906 to 1918, 447 "cadets" have been hired. Of this number 77, or 17 per cent, left for reasons other than the war. This is conclusive proof that there is an unquestioned use for the "cadets," both from the organization and individual standpoint. Eliminating the 77 from further consideration, leaves a remainder of 372 to be accounted for. Of this number 191, or 51 per cent, are now engaged in war work. This certainly indicates that the Doherty Organization has made a remarkable showing from a patriotic standpoint. There are 179 of this former and present "cadet" body left and a large proportion is expected to take up some branch of war work shortly.

New Appliances

Motor-Operated Instruments for Controlling Furnace Temperatures—Compressor Sets—Small Electric Hoists

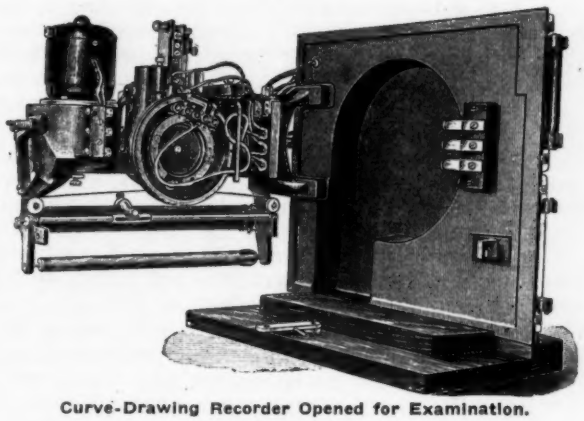
POWER-OPERATED ELECTRICAL INSTRUMENTS FOR MEASURING AND CONTROLLING TEMPERATURES.

Automatic Recording and Controlling Instruments Being Found Useful for Heat-Treating Furnaces.

The most precise electrical measurements are those made by a zero or balance method, such as the Wheatstone bridge and the potentiometer. In both no current flows through the galvanometer at the moment when the measurement is made and hence galvanometer errors are excluded. In the potentiometer, variations in the resistance of lead wires and of the source of electromotive force, such as a thermocouple, are also eliminated, the lead wires and thermocouple being in the same circuit with the galvanometer.

Zero methods, however, require external power for the balancing of the circuit. For single measurements this power is ordinarily supplied by the hand; a contact is moved along a slide wire or resistances are plugged in or out until the galvanometer comes to the zero position, when the quantity to be measured is at once known from the amount of resistance that has been used. The Leeds & Northrup Company, Philadelphia, Pa., has developed a line of power-driven recorders, however, in which the adjustments are made automatically, the galvanometer merely determining in which direction the adjustment is to be made.

Early attempts to use a galvanometer for this purpose were along the line of having the boom or pointer of the galvanometer close an electrical circuit. This, however, proved unsatisfactory, as with low voltages on the boom, contact would not be made through particles of dust, while with a higher voltage the boom would "freeze" or fuse to the contactor. In the Leeds & Northrup apparatus the boom serves merely as a mechanical trigger. A reciprocating part, kept in constant motion by a motor, is arranged not to strike the boom when the latter stands in the no-current position, but when the boom moves out of this position in either direction, the reciprocating part pushes it against another part which adjusts the bridge or potentiometer circuit, the amount of the adjustment being regulated according to the distance which the boom has swung, that is, to the unbalancing current through the galvanometer.

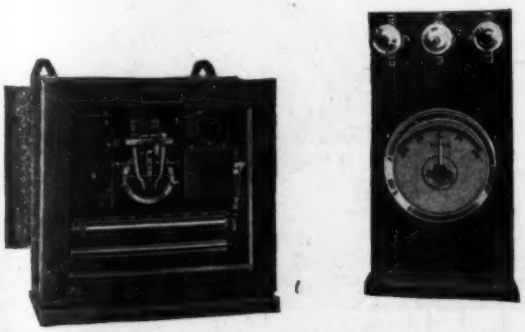


Curve-Drawing Recorder Opened for Examination.

The power of the motor is sufficient, not only for making the adjustments, but also for the operation of the chart drum or roll. For this purpose, however, the motor must run at a constant speed, that is, sufficiently constant, to give good time-keeping qualities, since the abscissas of the chart are laid off in hours and minutes. This has been found to necessitate the use of a special governor, and much time and research have been devoted to this problem. The governor finally adopted is of the centrifugal type and operates by opening and closing a shunt in the field circuit. When the motor is in operation this contact is continually on the make and break, as may be easily detected by listening to a telephone receiver connected in the circuit.

The motor not only adjusts the movable contact of the bridge or potentiometer, but also supplies power to move the recording pen. Multiple recording instruments which will record for a number of different thermocouples or resistance thermometers are also built. In these the motor operates the selector switch which connects the recorder to the different circuits and simultaneously turns a printing wheel which impresses upon the record sheet a dot to record the reading, and a number to identify the individual circuit which is being measured.

In the heat-treatment of metals, it is becoming more and more the practice to bring the leads from thermocouples in different parts of the furnace and in different furnaces to a central control station. That is facilitated by the introduction of base-metal thermocouples, which permits the prolongation of the couple itself to the measuring instrument, where the effects of temperature upon the cold end of the couple are readily compensated for, and by the adoption of the potentiometer method of measurement, with which differences in resistance of lead wires become immaterial. An attendant at the control station uses an indicating instrument, which he connects successively



Automatic Controlling Recorder With Furnace Indicator and Lamps.

to different thermocouples. Usually he is also provided with switches, by means of which he can light signal lamps for the guidance of the operators at the furnaces, usually a red light to indicate too high a temperature, a blue one to indicate too low a temperature and a white one to indicate the right temperature. A multiple-point recorder is generally installed to record the different temperatures automatically, one after the other. The Leeds & Northrup multiple recording instrument, for example, is built for as many as 16 different circuits.

Where it is preferred to have the signaling at the furnace done automatically, a Leeds & Northrup "single-point" or curve-drawing recorder is provided with contacts on the moving element by means of which the signal lamps will be lit, accordingly as the temperatures in the furnace are too high, too low, or correct. An interesting extension of this plan is to use two thermocouples in different parts of the furnace and to provide the recorder with a commutator by means of which it reads first on one and then on the other. The chart produced is a single line running alternately back and forth between the two temperatures and indicating the temperature difference graphically. At the same time the commutator controls a fourth signal lamp at the furnace to show which thermocouple is being measured.

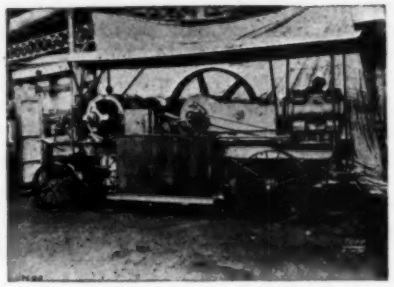
The double recorder is thus suitable for demonstrating uniformity of furnace temperatures or the lack of it. It shows graphically the effects of empty furnace, full furnace, or part full furnace, and how distribution of heat is affected by rates of firing, location of load, door and other losses, cold hearth, etc. It is a convenient means for investigating furnaces and showing how errors may be overcome by moving burners, baffles, or arches, or changing the method of introducing heat.

The use of this double recorder has exploded the old soaking-heat idea, since it demonstrates that it is practically impossible to bring many kinds of loads up uniformly to the desired temperature by holding the furnace at a constant temperature, without underheating some parts and overheating others. This type of equipment has been found of especial value in studying the heating of different kinds and sizes of sections or numbers of pieces, different methods of loading, speed of loading and unloading, mechanical furnacing, the heat treatment of large single pieces, such as gun forgings, etc.

CONTRACTORS' MOTOR-DRIVEN COMPRESSORS.

At this time when the labor problem is a large issue and economic solutions to it as a problem are a necessity, the portable compressor outfit seems more valuable than ever. Because of the rapidity with which they work and the immense amount of work they save, air-operated tools, such as drills, hammers, rivets, chisels, reamers, caulkers and tampers, have been very generally employed by contractors and builders. A portable compressor outfit, that can be readily hauled to the job, put immediately to work and promptly removed when wanted elsewhere, forms therefore a very valuable addition to the contractor's plant.

The electrically operated portable compressor illustrated is especially adapted for city work where current is available at all places, and it is much more conveniently and easily operated than corresponding steam, gasoline or oil-operated types. It consists of a 10 by 13 type ER Ingersoll-Rand compressor, driven by a 50-horsepower Westinghouse motor, and has a capacity of 300 cubic feet of air per minute at 100 pounds pressure.



Portable Motor-Driven Air Compressor for Contractors' Use.

SMALL ELECTRIC HOISTS.

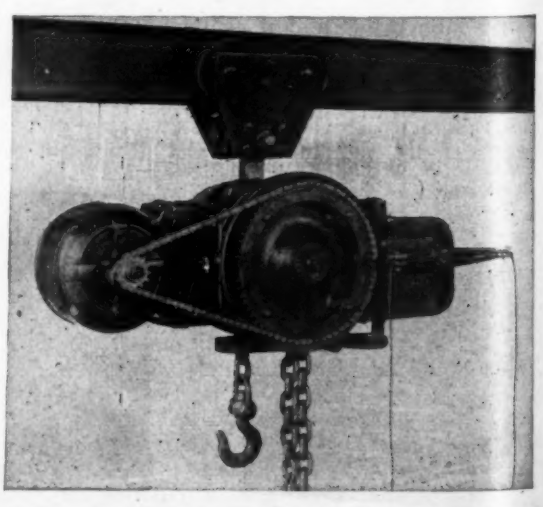
Small electric hoists which are adapted to almost every kind of work involving hoisting form a very economical means of hauling loads of from ½ ton to 5 tons, because they can lift with from five to ten times the speed of a hand-operated chain hoist and their cost is but a fraction of that of an electric traveling crane. They can be suspended from a fixed point, shear pole, jib crane, trolley running along an overhead track, or small traveling crane. The trolley or crane when used can either be pulled along by hand or by motor.

These little hoists are controlled from the floor by means of pendent ropes. A brake, which is automatically applied when the controller is returned to the off position, holds the load suspended, and a safety switch automatically cuts off the current when the hook in hoisting reaches its safe limits of travel.

Special mechanical and electric features are used in the construction of the motors to suit the service, which are of Westinghouse type. The direct-current motors are modifications of the series-wound crane type. The alternating-current motors are of the polyphase squirrel-cage type with high-torque rotor windings.

The controllers of the drum type are designed to break heavy currents without burning the contacts. When the tension on the control ropes is released, a spring returns the controller to the off position.

The hoist illustrated is built by the Yale & Towne Manufacturing Company, New York City, and is completely equipped with Westinghouse electric apparatus.



Typical Electric Hand-Controlled Hoist Arranged for Running on I-Beam Trolley.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

MARLBORO, MASS.—Plans are being prepared for the erection of a power plant, 30x40 feet in dimensions, at the works of the Koehler Manufacturing Company on Howland street, to cost approximately $20,000.

BRIDGEPORT, CONN.—In connection with the erection of the proposed new sewerage treatment plant by the city to cost in the neighborhood of $300,000, a new pumping station will be constructed on Bostwick avenue. The Eastern Engineering & Construction Company, Derby, is the contractor.

HARTFORD, CONN.—Spencer Turbine Company, 620 Capitol avenue, has awarded a contract for the erection of a one and two-story plant, about 75x300 feet and 40x75 feet, respectively, to be located on New Park avenue. R. G. Bent & Company, 904 Main street, Hartford, are the contractors.

BINGHAMTON, N. Y.—Binghamton Bridge Company has acquired property at Port Dick, near Binghamton. It is said that the company is planning to erect a new hydroelectric plant at the site at a later date, to include the construction of a concrete dam, one-story brick power house, and the installation of turbines, generators and other equipment.

BUFFALO, N. Y.—In connection with the new drawbridge now being erected by the city over the Buffalo river at Abbott Road, electrical machinery will be installed for operating the draw span. The bridge will be of the lift type and it is understood that the electrical equipment will be placed in service some time before the close of the year.

LANCASTER, N. Y.—Depew & Lancaster Light, Power & Conduit Company has filed notice with the Public Service Commission that a new schedule of rates for service will be placed into effect on September 1.

BUFFALO, N. Y.—American Purchase Sales Corporation, 528 Ellicott Square, has had plans prepared for the erection of a boiler house and pumping plant at its works, one-story, about 20x30 and 25x25 feet in dimensions, respectively. Martin C. Miller, Mutual Life building, is architect.

NIAGARA FALLS, N. Y. — U. S. Light & Heat Corporation, 3215 Highland avenue, has had plans prepared for the erection of a new addition to its plant. The structure will cost about $42,000.

WESTFIELD, N. Y.—The borough officials have had plans prepared for the erection of a new brick and concrete pumping station. It is understood that the structure, which is estimated to cost in the neighborhood of $35,000, will be electrically-operated.

CALDWELL, N. J.—A new telephone line is being constructed from Caldwell to the Big Piece Meadows rifle range properties of the Government. The work will require the placing of about 100 new poles and the installation of lines.

DOVER, N. J.—New Jersey Power & Light Company is making rapid progress in the extension of its electric lighting system to Upper Hibernia. The company will furnish service to the mines, workshops, offices, and auxiliary buildings of the Wharton Steel Company.

JERSEY CITY, N. J.—Hough Manufacturing & Sales Company has filed notice of authorization to operate a works at 512A Bergen avenue for the manufacture of gas and electric appliances. John A. Hough, 15 Lexington avenue, heads the company.

NEWARK, N. J.—Crocker-Wheeler Company, Ampere, manufacturer of generators, motors, etc., has had plans prepared for the erection of a one-story addition, about 90x90 feet in size, at North Twelfth street and Fourth avenue. The company has taken out a building permit for the structure.

HAZLETON, PA.—Fire, on July 30, caused by a bolt of lightning, damaged the substation of the Hardwood Electric Company to the extent of approximately $5000. The supplying of electric service to a number of plants, etc., in the vicinity was partially suspended for a number of hours. The damaged section of the plant will be immediately rebuilt.

PITTSBURGH, PA.—Crucible Steel Company, Thirty-eighth street, has had plans prepared for the construction of a new boiler plant and extensions in its ash handling system at its works on Belmont street near Ridge avenue. The entire work is estimated to cost $20,000.

PITTSBURGH, PA. — Pennsylvania Chocolate Company, Center avenue, has had plans prepared for the construction of a brick power plant addition to its works in connection with a seven-story factory building, the entire work to cost approximately $100,000. The company has taken out a building permit for the structure.

SOUTH BETHLEHEM, PA.—Philadelphia & Reading Railway Company has had plans prepared for the erection of a new local engine house and power plant to be located on Saucon Creek. The latter structure will be about 35x75 feet.

TARENTUM, PA.—The Board of Managers of the Allegheny Valley Hospital has commenced the construction of a two-story boiler plant at the institution. The work is estimated to cost $10,000.

WASHINGTON, D. C.—The United States Government, Navy Department, has had plans prepared for the construction of an extension to the local boiler plant, to cost approximately $150,000.

MORGANTOWN, W. VA. — West Virginia Traction & Electric Company and the Randall Gas Company, both of Morgantown, have been granted permission by the Public Service Commission to increase their rates for service.

SPARTANBURG, S. C.—South Carolina Light, Power & Railway Company will extend its lines to Whitney and Congress. Address F. H. Know, vice-president.

NORTH CENTRAL STATES.

BRYAN, OHIO.—The City Council has passed an ordinance, authorizing an issue of $90,000 in bonds, the proceeds of which are to be used for extensions and improvements to municipal electric light plant and water-works system.

CLEVELAND, OHIO.—Electric Products Company has under consideration the construction of a new factory, 90x176 feet in size, to be located at 1723 Clarkston Road.

ANDERSON, IND.—The municipal electric light plant must be rebuilt according to Harry J. Williams, consulting engineer, of Dayton, Ohio. The enlargement of the steam department, larger buildings and general re-arrangement will cost about $150,000. To provide the money will require another bond issue. It is estimated that seventy per cent of the industries in Anderson are using power from the municipal plant, as well as electric current. A number of large consumers have notified the city authorities that they will need larger allotments of light and power for industrial work.

GARY, IND.—Elgin, Joliet & Eastern Railway Company will erect buildings on its property here at a cost of $41,000. Among the improvements will be a dormitory to accommodate fifty workmen and a coaling station.

HAMMOND, IND.—Construction has been begun on the new twenty-four mill addition to the Gary tinplate plant of the American Sheet & Tin Plate Company, to cost about $10,000,000. Pressing need for tinplate for war work has caused the Government to ask the Steel Corporation to expand its production facilities and the Gary tinplate plant will be doubled.

ROCKFORD, ILL.—The petition of the Rockford City Traction Company for permission to raise the car fare to six cents has been denied by the Illinois Public Utilities Commission.

FLINT, MICH.—An ordinance has been passed by the council requiring the electric wires to be placed underground in certain districts. Address C. S. Mott, mayor.

GLOBEVILLE, MICH.—The village council is planning ways and means to secure electric light. Address village clerk.

SHEBOYGAN, WIS.—Eastern Wisconsin Electric Company will extend its power line from Black Creek to Appleton.

MANKATO, MINN.—The Mankato division of the Northern States Power Company has accepted contract from the Hubbard Milling Company covering 100 horsepower in motors.

WEBSTER, IOWA.—Illinois Central Railway Company will erect a $75,000 machine shop and power house. Electric equipment is included in the specifications. Address A. D. Baldwin, chief engineer of the company, Chicago.

JEFFERSON CITY, MO.—Hays Wood Products Company contemplates installation of a power plant for heating and electric power to cost $20,000.

KANSAS CITY, MO.—Kansas City Light & Power Company will erect a substation at 12th and Bristol avenue. Address A. E. Bettis, superintendent.

SPRINGFIELD, MO.—Springfield Gas & Electric Company is planning for the erection of a new electric power station. Immediately upon the completion of the structure, a 10,000-horsepower turbine and auxiliary apparatus will be installed.

ST. JOSEPH, MO.—St. Joseph Railway, Light, Heat & Power Company is considering plans for the construction of a new electric substation on Felix street, between Second and Main streets.

WARRENSBURG, MO.—An electric light plant is to be built here.

BAXTER SPRINGS, KANS. — A municipal electric light system may be the next civic improvement in Baxter Springs, Mayor E. L. Wright addressed the city council in regard to the lighting service now furnished the city by the Empire District Electric Company.

CHANUTE, KANS.—An election to vote $35,000 bonds for the extension of the municipal electric light plant was held August 6 in order to save the expense of a special election.

CHENEY, KANS. — Electric light bonds in sum of $10,000 have been sold to Vernon Branch Bond Company of Wichita and $5000 to the Cheney State banks.

DOWNS, KANS.—The light company at Downs, which furnishes current to a number of towns, failed in its attempt to have the state utilities commission allow it to raise rates. The service to the towns has been miserable for a long time and much complaint is registered. The towns all opposed the raise. The company was told to install the new boilers and improve the service and then appear before the commission at the end of 60 days.

FRANKFORT, KANS.—Ordinance passed amending Section 7 of Ordinance 191 of the city of Frankfort, Kans., being entitled "An ordinance authorizing the Frankfort Light & Power Company, its successors, associates and assigns to maintain and operate an electric light and power plant in said city." It has been amended so as to read in part as follows: "The said light and power company shall install one steam engine of not less than 150-horsepower capacity and one not less than 125-kilowatt generator. Meters may be installed and owned by consumers, or if desired shall install and maintain meters.. J. M. Barker, city clerk.

DATES AHEAD.

Association of Iron and Steel Electrical Engineers. Annual convention, Southern Hotel, Baltimore, Md., September 9-14. Secretary, John F. Kelly, McKeesport, Pa.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual convention, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

Michigan Section, N. E. L. A. Annual convention, Pantlind Hotel, Grand Rapids, Mich., September 17 and 18. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

International Association of Municipal electricians. Annual convention, Atlanta, Ga., September 24-27. Secretary, Clarence R. George, Houston, Tex.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., September 27 and 28. Secretary, Miss O. A. Bursiel, Boston, Mass.

American Electrochemical Society. Fall meeting, Princeton, N. J., September 29 to October 1. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

American Electric Railway Association. Annual meeting, Atlantic City, N. J., October 8 and 9. Secretary, E. B. Burritt, 8 West 40th street, New York City.

Jovian Order. Annual convention, Dallas, Texas, October 14-15-16. Mercury, Ell C. Bennett, 1415 Syndicate Trust building, St. Louis, Mo.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kans.

Western Society of Engineers, Electrical Section. Annual meeting, Chicago, January 28-30, 1919. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

PHILLIPSBURG, KANS.—A transaction of considerable magnitude was consummated recently when the Phillipsburg Light & Power Company closed its books and turned the plant over to a new company composed entirely of Phillips county men.

SENECA, KANS.—Ordinance passed authorizing and directing the mayor and city clerk of Seneca, to execute a supplemental contract to a contract of date July 1, 1912, between Seneca and Oneida, for and on behalf of Seneca with Oneida, for the purpose of supplying electric current over the transmission line of Oneida, to resell electric current to Bern, and the inhabitants and customers for lighting, heating and power purposes and providing the rate. John T. Campbell, city clerk.

BEATRICE, NEB.—An election will be held to decide the question of issuing $100,000 in bonds to improve the city lighting plant.

PALMER, NEB.—Contract will be awarded late in August for waterworks and electrical improvements. Henningson Engineering Company, 12th and Farnum street, Omaha, engineers.

MADISON, S. DAK.—The plant of the Madison Water & Electric Light Company was destroyed by fire with a loss estimated at $10,000. Address city clerk.

MITCHELL, N. DAK.—The authorities at Washington have granted permission for the issue of $175,000 in bonds for improving the light and water system. Engineers Burns & McDonnell, 400 Interstate building, have prepared the estimates.

NEW ENGLAND, N. DAK.—Ashby Light & Power Company will construct a power house and electric light plant. Address manager.

SOUTH CENTRAL STATES.

FLORENCE, ALA.—Work will begin at once by the Muscle Shoals Traction Company on its proposed railway to connect Huntsville and Florence.

GULFPORT, MISS. — The United States Government, Navy Department, has awarded a contract to the Cooper & Greer Company, Gulfport, for the installation of a new fire protection system at the local naval station.

DE QUEEN, ARK.—Commonwealth Public Service Company, of Muskogee, Okla., has purchased the local electric light plant of the Arkansas Light & Power Company.

ENID, OKLA.—The Enid division of the Oklahoma Gas & Electric Company will supply 45 horsepower additional to the city water works for operating three additional wells which the city has opened.

PICHER, OKLA.—Picher is to have an electric light system.

LUBBOCK, TEX.—The city council will soon award the contract for constructing a municipal electric light and power plant, bonds in the sum of $35,000 having already been issued for the purpose.

MERCEDES, TEX.—In connection with the construction of the proposed large pre-cooling plants of Wetegrove & Company, to be located in the Rio Grande Valley, a quantity of equipment, including fans, ventilators, and other apparatus, will be installed.

RANGER, TEX.—The Chamber of Commerce is promoting the organization of a local company to construct an electric light and power plant here.

SAN ANGELO, TEX.—San Angelo Water, Light & Power Company plans to install a modern filtration plant to cost $14,050.

WESTERN STATES.

PUEBLO, COLO.—Arkansas Valley Railway, Light & Power Company is considering the electrification of the water works which supplies the northern part of the city. Approximately 800 horsepower will be required.

PHOENIX, ARIZ.—The municipal water works plant is to be equipped with three additional electric pumps, each of a capacity for lifting 6000 gallons of water a minute. The city will also install electric low lift pumps to handle surface waters in conjunction with the new drainage system that is being constructed in the Salt River Valley.

EVERETT, WASH.—Interstate Engineering Company will construct a large new plant at Everett. The main buildings for the manufacture of machinery will be 400x600 feet and four stories high.

SEATTLE, WASH.—The city utilities committee of the city council has adopted the recommendation of Thomas F. Murphine, superintendent of public utilities, for an interchange of transfers between the city street car line at 17th

avenue Northwest and the Greenwood line, owned by the Western Washington Power Company. The recommendation of the superintendent for purchase of 25 street cars was also adopted and will go before the council for final adoption.

SEATTLE, WASH.—J. D. Ross, superintendent of the Seattle Lighting Department, is endeavoring to ascertain how soon material can be obtained for erection of an additional 10,000-kilowatt steam operated electrical unit in order to meet new industrial demands for power that can not be met with the present equipment. The unit may be added to the Lake Union plant or at one of the coal mines along the high tension line on the Cedar river.

HOOD RIVER, ORE.—The Pacific Power & Light Company has completed a link in the high-voltage line near White Salmon, Washington, connecting the Hood river and White river plants with the large plant of the Northwestern Electric Company on the White Salmon river. With this connection patrons of the Pacific Power & Light Company at Hood River, Oregon, The Dalles and Mosier, Oregon, are assured of continuous service. The power is transmitted across the Columbia river on six cables.

MARSHFIELD, ORE.—Oregon Power Company has contracted for supplying additional electric service to the amount of approximately 200 horsepower to the local sawmills engaged in the manufacture of airplane stock for the Government.

PORTLAND, ORE.—Northwestern Electric Company will construct an open wharf in front of its new power station in South Portland to cost $12,000.

COALINGA, CAL.—The City Council has approved a bond issue for $20,000, to provide for the construction of a municipal pumping plant. It is understood that the station will be electrically-operated.

FRESNO, CAL.—Plans are under consideration by the San Joaquin Light & Power Company for the construction of hydroelectric power stations on Dinkey Creek and the north branch of the Kings river.

NEWPORT, CAL.—The Newport Mesa District is considering plans for the erection of an electrically-operated pumping plant in connection with the proposed irrigation system at Newport Beach.

LOS ANGELES, CAL.—Fairbanks-Morse Company is planning for the immediate installation of a electric-lighting plant at Big Bear Lake Tavern to cost about $4,500.

LOS ANGELES, CAL.—F. E. Newberry Electric Company has been awarded the contract for furnishing the lighting fixtures for the community mausoleum now in course of construction in the Forest Lawn Cemetery at Tropico.

LOS ANGELES, CAL.—In connection with the new cannery to be erected at San Jose by the California Growers' Association, Douglas building, electric machinery will be installed to cost about $250,000. Vernon Campbell is manager.

LOS ANGELES, CAL.—The city is planning for the construction of a new electric substation on the tidelands in Los Angeles harbor to be used for the generation of power for municipal use.

CANADA.

PORT ARTHUR, ONT.—Actual construction work on the Nipegon Power Development at Cameron Falls has commenced. The first unit of development will be 30,000 horsepower and will be turned on in Port Arthur and Fort Mills by December, 1919.

CLOVERDALE, B. C.—Officials of the Whitlock Waterworks, Ltd., recently signed a contract with the B. C. & E. R. Company for extension of power and light transmission line to the waterworks pumping station. Preparations are being made for transforming the plant from gasoline to electric motive power.

VANCOUVER, B. C.—British Columbia Electric Company is constructing a reinforced concrete substation. Building is 100 x 60 feet. The electrical equipment in the new station will consist of two rotary converters of 1000 kilowatts each and one motor generator set of 1500 kilowatts. Both air-blast and water cooled transformers will be used and there will be the usual oil switches, lightning arresters and arc circuits.

PROPOSALS

POWER PLANT EQUIPMENT.—The City Council of Pierre, S. Dak., will receive bids August 26 for labor and material necessary for the construction of a central power plant to furnish water to the city. The specifications include engines, generators, switchboard, transformer, boiler, feed pump, feed water heater, condenser equipment, brick power plant building, etc. Address City Auditor J. A. Rose.

CONDENSERS AND PUMPS.—Bids are to be received by the Bureau of Yards and Docks, Navy Department, for furnishing and installing two surface condensers for a 3750 kilovolt-ampere turbo-alternator, two motor-driven circulating pumps, one motor-driven flushing pump, auxiliary pumps for the condensers on foundations provided by the Government at Bremerton, Wash., and at Philadelphia. Specification No. 3085 is to be had of the commandants of the yards.

ELECTRIC EQUIPMENT FOR PUMP HOUSE.—The East Liverpool Drainage and Levee District will receive bids August 12 for electric equipment for pump house at Lewiston, Ill. Address C. M. Johnson, chairman of commission, Canton.

STORAGE BATTERIES, PIPE COVERING, ETC.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until August 14 for galvanized pipe, sizing wire, brass tubing, storage batteries, pipe covering, etc. Blanks and further information relating to this circular (1225) may be obtained at the above office.

GENERATING SETS AND SWITCHBOARD.—Bids will be received at the office of the lighthouse inspector, Boston, Mass., until August 20 for generating set and switchboard. Further information may be obtained upon application to the above office.

INCORPORATIONS

LOUISVILLE, KY. — Louisville Storage Battery Company has filed articles of incorporation with a capital stock of $15,000 with authority to incur an indebtedness not to exceed $10,000. The incorporators are W. G. Heister, A. G. Heist and Walter Huffaker.

BROOKLYN, N. Y.—Brooklyn Electric Welding Corporation. Capital, $50,000. To operate an electrical welding establishment. Incorporators: H. B. Payne, J. Kjeistad, and J. B. Morris, 764 Court street, Brooklyn.

NEW YORK, N. Y.—Chadburn (Ship) Telegraph Company of America, Inc. Capital, $50,000. To engage in the manufacture of electrical appliances. Incorporators: W. P. Allen, Brooklyn; F. A. Whitney, and J. L. Galey, 39 West Twenty-seventh street, New York.

NEW YORK, N. Y.—Erdman Forced Draft Burner Company. Capital, $12,000. To manufacture burners for power plant use. Incorporators: W. Chenault, C. C. Rossire, and E. S. Nash, 26 Cortland street.

GARBER, OKLA.—Garber Light & Ice Company. Capital, $20,000. To operate a local electric plant. William Musser is the principal incorporator.

ORANGEBURG, S. C.—Orangeburg Heating Company. Nominal capital, $5000. To manufacture heating apparatus. Incorporators: P. M. Smoak and M. P. Burt.

DALLAS, TEX.—Dallas Presto Battery & Service Company. Nominal capital, $5000. To manufacture electric batteries. Incorporators: J. V. Crannell, H. J. Crannell, and P. C. Vines.

NORFOLK, VA. — Tassin Battery Corporation. Capital, $45,000. To engage in the manufacture of electric batteries. C. H. Hix, president; and R. H. Baker, secretary.

MULLENS, W. VA.—Wyoming Water & Light Company has incorporated to operate light, water and heat company with a capitalization of $50,000. The incorporators are D. D. Maron, A. W. Daubenspeck, D. M. Klein, N. C. Bunch, J. A. Radwan and L. R. Taylor, all of Mullens.

RIPON, WIS. — Central Wisconsin Utilities Company has incorporated with a capital of $150,000. Address D. E. Lorigan.

NEW PUBLICATIONS

MANUAL OF IRON, STEEL AND NONFERROUS METALS.—The Iron Trade Review, Cleveland, Ohio, has issued an up-to-date price manual of iron, steel and non-ferrous products as fixed by the Government, and as now in effect. It comprises maximum base prices, differentials and extras, and is contained in a pamphlet of 75 pages, including a complete index of subjects and divisions.

Trade Activities

Pyroelectric Instrument Moves Into New Quarters—Franklin Williams, Appointed Manufacturer's Agent—Catalogs

Salisbury Electric Company, Ltd., electrical engineer, contractor and manufacturer of electrical appliances, announces its removal from 49 Wellington street, East, Toronto, to larger and more commodious premises at 615 Yonge street.

Pyroelectric Instrument Company, manufacturer of special type electric furnaces, pyrometers, etc., Trenton, N. J., recently moved its plant from 148 East State street to new and larger quarters located at 636 East State street.

The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, is distributing its Bulletin No. 22, which describes its Arcmaster, solenoid switches and automatic-reset overload relays. These devices are especially designed for the protection of direct current, series motors and controllers such as are used on street cars, mining locomotives, electric cranes and the like. The bulletin is well illustrated, sets forth the need for these devices and explains their operation.

Central Telephone & Electric Company, importer, manufacturer and jobber, St. Louis, Mo., has just issued several new sheets for insertion in its loose leaf catalog published some time ago. These pages illustrate and describe Union renewable fuses, Westinghouse fans and heating devices, showing revised prices on each item. Looseleaf pages describing telegraph instruments, medical batteries, vacuum cleaners, etc., are also being distributed by the company. The Central Telephone & Electric Company is the agent jobber for the Westinghouse Electric & Manufacturing Company in St. Louis territory, and carries a full line of Westinghouse supplies and apparatus in addition to its regular line of central station construction material and all kinds of contractors' supplies.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just issued an eight-page envelope folder entitled "C-H Electric Soldering Irons and Hand Tools." The folder shows two views of the soldering iron which has a threaded heating core over which the tip is screwed. A new automatic rack is explained in detail. The illustration shows a workman placing a soldering iron on the cradle hook of the rack which action causes a resistance to be inserted in series when not in use, while at the same time keeping it warm enough for instant use when started. A six-inch current regulating plate which provides temperature control where different grades of iron are being done and the convenient C-H 7050 feed-through switch for installation on the heater cord, are also illustrated.

Locke Insulator Manufacturing Company has moved its general office from Rochester to Victor, N. Y., where its factory is situated.

National Pipe Bending Company, New Haven, Conn., announces the appointment of Franklin Williams, Inc., 39 Cortlandt street, New York City, to act as its representative in New York City and surrounding territory. F. N. Currier is president of the company and E. T. Franzen secretary and treasurer.

W. G. Nagel Electric Company, Toledo, Ohio, has issued Nagel motor list No. 25, revised to July 15, which offers attractive bargains in new and remanufactured motors and generators, of both alternating and direct current types. Complete information as to the make, type, horsepower, speed, etc., of each item is contained in the booklet. Every machine sold by the Nagel Company is claimed to be modern in every respect and as good as a new motor so far as appearance and satisfactory service are concerned. Every piece of machinery is given a two-hour running test before leaving the plant, during which time its performance is carefully watched by an expert.

Marron Manufacturing Company, Rock Island, Ill., is the manufacturer of farm lighting plans and complete electrical equipment for the house. One of the most recent developments of this company is a farm lighting plant and water system, which not only supplies a superior lighting system but provides ample belt power for overhead shafting and direct-connected machinery. Thus, the housewife and all hands are relieved from those tasks which consume time and strength that can be more profitably employed elsewhere. The Marron power and light plant contains just four units—engine, generator, switchboard and batteries. The engine, generator and switchboard are all built in the Marron factory. In keeping with these highly efficient units, the Edison battery is used as the standard battery, and with it a specially designed automatic cut-out is used. It is supplied so that when lights are used while charging the batteries, the voltage does not exceed 32 volts on the lighting line. An automatic connection, which is a part of the cut-out, performs this service. The power unit of the Marron power and light plant is one of the most powerful and economical engines of its type and is the result of years of experimental work, involving a tremendous cost. This plant is without doubt one of the most efficient farm lighting plants and water systems on the market and merits the attention of any one in need of such equipment. The demand for this farm lighting outfit is large, indicating rural prosperity.

Gray & Barash, electrical engineers and manufacturers, 63 Horton street, Seattle, Wash., are doing an extensive business in the manufacture of overhead type of electrically-operated cranes. They are at present building for J. F. Duthie & Company, shipbuilders of Seattle, five five-ton cranes; a 25-ton crane for the Seattle Boiler Works; 10-ton crane for the Seattle Car & Foundry Company; a 10-ton crane for the Pacific Machine Shop & Manufacturing Company, and 40-ton crane for the Skinner & Eddy Corporation, shipbuilders. Other work includes the rebuilding of a 750-kilowatt turbine for the Clearlake Lumber Company at Clearlake, Wash.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., on July 27 held its eleventh annual picnic at Waukesha Beach, Pewaukee Lake, Wis., and was attended by a large number of C-H employees and their families. The main office and works of the Cutler-Hammer Manufacturing Company were closed for the day. The Wisconsin Gun Company also closed to permit its employees to attend, many of whom were formerly with the Cutler-Hammer Company. The program provided athletic events for boys and girls both young and old. All the prizes awarded consisted of various amounts of thrift stamps. The program and all arrangements for the day's outing were in charge of the employees activities committee.

John F. Godfrey, manufacturer of the John F. Godfrey coal conveyor, Elkhart, Ind., has issued an instructive little pamphlet entitled "Help Win the War By Stocking Coal Now." This is a four-page pamphlet that tells how to insure against the coal famine and cut the labor cost of storing coal. The Godfrey coal conveyor is capable of handling 50 tons of coal per hour, and this pamphlet takes up the various mechanical details of the Godfrey coal conveyor. Five illustrations show the application of the Godfrey coal handling equipment to various instances, the coal stored in a pile and run direct to the hoppers over the boiler, from railroad track to coal storage bin of wood, the use of equipment for carrying coal into boiler room and carrying ashes out. Six views are given of the various mechanical details of the coal conveyor in use, showing specifically the grab-bucket and carrier in use, and junior and standard conveyors. Specifications for base and track equipment, with prices, are also given. Throughout the pamphlet the theme has been "Keep your plant running all winter." The bulletin makes good reading for everyone operating coal-using plants. Storing coal now is not only an act of patriotism. It is necessary for self-preservation, for those wanting to keep their plants running.

Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Electrically Heated Cup (1,269,646).—Deflectors are provided for causing the liquid to circulate on opposite sides of the heating element, according to this patent to William P. Robertson, of New York City.

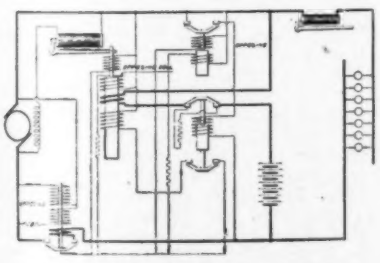
Chain for Pull Sockets (1,270,143).—A bead chain consisting of hollow balls connected to each other by

No. 1,270,143—Bead Chain for Pull Sockets.

dumb-bell links, at least one element of each group being of insulating material. Patent assigned by William J. Gagnon to the Bead Chain Mfg. Co., of Bridgeport, Conn.

Alternating-Current Rectifier (1,269,891).—A series of brushes arranged in staggered relation on opposite sides of a holder is used by Fred. Woodside and Doss Wright (both of Dillon, Mont.) in connection with the commutator of a rectifier.

Electrical Distribution System (1,268,438).—In car lighting or the like, where a generator driven at variable



No. 1,268,438—Distribution System.

speeds supplies the lighting current and also charges a battery for furnishing current when the generator is at rest, the generator voltage is apt to rise too high before the charging of the battery can be stopped. To avoid this, Gorham Crosby (of Glen Ridge, N. J.) provides circuits including a magnetic switch which automatically stops the charging of the battery while permitting the generator to continue feeding the circuit.

Spot Welding Machine (1,269,617).—In the machine of this patent, assigned by Joseph Ledwinka to the Edward G. Budd Mfg. Co., of Philadelphia, a series of electrodes is successively forced into position and all held in operative position.

Tank Switch (1,269,684).—A switch controlled by an arm carrying a float and hence adapted to control the circuit to a motor driven pump. The patent was assigned by James W. Cox of Wilmette, Ill., to the Pacific Flush Tank Co., of Chicago.

Battery Depolarizers (1,269,913 to 1,269,916).—These four patents, all assigned to the National Carbon Co., all relate to manganese depolarizers for primary batteries and the methods of making the same.

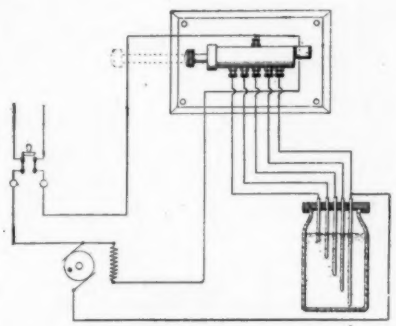
Squirrel-Cage Motor (1,269,909).—The stator windings are immersed in an insulating liquid contained in an inclosure which is water-tight and which permits of obtaining a substantial equilibrium in pressure when the motor is immersed in water at varying depths.

Electric Rust Prevention (1,269,926).—To prevent corrosion, Carlos I. Gesell (of Mamaroneck, N. Y.) makes the metal the negative electrode of a voltaic cell, but first coats the metal with a non-metallic paint having holes or fissures which limits the access by the sea water (or other electrolyte) to the metal.

Emergency Car Lighting (1,269,712).—A switching arrangement for controlling auxiliary lighting circuit from a battery, for use in emergencies in connection with cars in which the regular lamps are connected in series across the mains. Patent assigned by John W. Depson, of Depew, N. Y., to the Gould Coupler Co.

Measuring the Field Strength of Dynamos (1,270,100).—To determine the field strength of a dynamo, Edwin C. Ballman, of St. Louis, connects it in circuit with a reactance whose magnetic reluctance is substantially constant, and then measures the current in the circuit, the resistance of the circuit being small in comparison to its reactance.

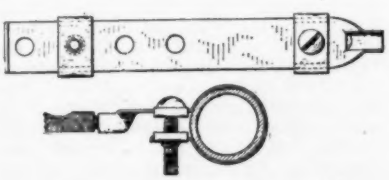
Water Rheostat (1,268,666).—Electrodes of varying sizes are immersed in water and connected to a switch which makes step-by-step connections to the electrodes and which is held in one extreme position by a no-load magnet, the arrangement being intended particularly for use as a motor starter. Patented by William A. Archibald and Harold W. Thom, both of Tyler, Pa.



No. 1,268,666—Water Rheostat.

Storage Battery (1,269,778).—Glass wool is used as a separating material between spirally wound electrode sheets in the battery of Julius Becker. The capillarity of the glass wool is to carry the electrolyte to the faces of the electrodes. The patent was assigned to John P. Mentzer, of Chicago.

Ground Clamp (1,268,457).—A perforated slide on a strap is adapted to register with any one of a number of holes in the strap, thereby affording adjustable sockets for the screw when used with different sizes of piping. Patent assigned by Howard H. Haynes and Tonjes A. Both to the Connecticut Electric Mfg. Co.



No. 1,268,457—Ground Clamp.

Ventilating and Cooling Apparatus (1,270,352).—An invention appropriate to these torrid days is the idea of James A. Williams, of Roxbury, Mass., who has an electric fan blow its breeze into a chamber with ice containers so disposed that the blast of air is well cooled before emerging from the outlet.

Men in Service

Milan V. Ayres Appointed Major—H. M. Byllesby Called Overseas—A. O. Boniface Joins War Industries Board

J. G. FISHER, distribution superintendent of the Drumright, Okla., division of the Oklahoma Gas & Electric Company, has been called into military service.

JOHN NAESER, of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., recently left for Camp Zachary Taylor, Louisville, Ky., where he became a member of the National Army.

H. M. ST. JOHN, research engineer in the testing department, Commonwealth Edison Company, Chicago, has left for Cleveland, Ohio, where he will do special chemical work for the United States Army.

LIEUTENANT GEORGE A. BILSBARROW, formerly of the St. Louis plant of the Southwestern Bell Telephone System, is among those reported severely wounded on the casualty list of July 23. Lieutenant Bilsbarrow enlisted in the First Regiment, Missouri National Guard, now a part of the 138th Infantry.

W. G. WILLIAMS, results engineer of the Empire companies, has been appointed engineer in charge of fuel conservation in the mid-continent field by the petroleum division of the United States fuel administration. The appointment is for the duration of the war and Mr. Williams will have his office in Oklahoma City.

PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS reports that during the month the following men have entered military service: Fred Stoll, of Station No. 8, who is at Great Lakes; John Charry, of the line department, and James Connor, Arthur Benson, Charles Hinz, George Allin and Frank Steglic, all of the station construction deartment. Harry Brown, formerly of the meter department, is an instructor in the motor school at Camp Jackson, S. C.

MILAN V. AYRES, senior electrical engineer for the eastern district, Bureau of Valuation of the Interstate Commerce Commission, has resigned that position to accept an appointment as major in the National Army. Mr. Ayres was born in Kansas in 1875 and was graduated from the electrical department of the Massachusetts College of Technology at the age of twenty-three, and soon after entered the employ of the General Electric Company at Schenectady in the testing department. In 1903 he became electrical and mechanical engineer for the Boston & Worcester Street Railway, South Framingham, Mass. In July, 1911, he was appointed assistant to the general manager of the Rockland Light & Power Company, Nyack, N. Y., and in November of the same year resigned to accept a position as chief engineer of the Mobile (Ala.) Light & Railroad Company. In the following year he associated himself with Ford, Bacon & Davis, consulting engineers, New York City, with whom he remained until he became connected with the Interstate Commerce Commission in 1914.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

UNDERWRITERS' LABORATORIES displays a service flag, containing 55 stars representing that number of its men now serving with the colors.

PRIVATE CHARLES E. HAMILL, of Harrisburg, Pa., formerly connected with the Bell Telephone Company, has sent word of his safe arrival in France with the Eleventh Replacement Detachment of the Aviation Section of the Signal Corps.

PATRICK FITZGERALD, assistant superintendent of the Northern States Power Company, and JOE COLUMBO, also of the Northern States Power Company, Stillwater, Minn., division, have joined the army, making a total of 12 stars in the Stillwater service flag.

H. O. CLARK, JR., commercial manager of the Houston Lighting & Power Company, Houston, Tex., has received an appointment from the Government to assist the local aviation construction and field officers in an advisory capacity in problems concerning their electrical installation at the local army cantonment.

SOUTHWESTERN BELL TELEPHONE COMPANY during the past mnth added 121 names to its roll of honor, passing all previous records of enlistments in Government service. Thirty of this number are from the Missouri branch of the company, 2 from Kansas, 9 from Arkansas, 48 from Oklahoma and 32 from Texas. Fourteen men who had enlisted were discharged and returned to service with the company.

W. J. NEELY, of the testing department of the Commonwealth Edison Company, Chicago, has just received his commission as second lieutenant of engineers, after graduating from the Reserve Engineer Officers' Training School at Camp Lee, Virginia. He is at present stationed at Camp Humphreys, Virginia, with a railroad regiment. After leaving the company he was with the 341st Infantry at Camp Grant.

A. J. MITCHELL, foreman of the inside wiring department of the Public Service Company of Northern Illinois, left for the training camp at Peoria on June 15, and has already been promoted to corporal.

A. O. BONIFACE, superintendent of inspections at the Underwriters' Laboratories, Chicago, is now in Washington, D. C., as fire appliance expert, assisting W. H. Merrill in the work of Fire Prevention Section of the War Industries Board of the National Council of Defense.

H. M. BYLLESBY, who has been actively engaged in service with the aviation section of the United States Signal Corps, and recently promoted to the rank of colonel, has been called overseas for service. He has established headquarters with the Guaranty Trust Company of London, England, and his new duties "over there" will involve the purchase of supplies for the allied armies. Prior to his appointment by the War Department, Colonel Byllesby was very active in civilian war work in various capacities, and his patriotic efforts as an organizer and presiding officer of patriotic meetings in Chicago and as member of the executive committee of the Red Cross are well known. In civilian life Colonel Byllesby is president of H. M. Byllesby & Company, whose properties now serve about 2,000,000 people in upwards of 50 communities.

Obituary.

CAPT. HOWARD C. MCCALL, eldest son of Joseph B. McCall, president of the Philadelphia Electric Company, was killed in action on July 20, according to official information received. He received his commission after attending the Officers' Training Camp at Fort Oglethorpe, and was assigned to the 59th Infantry, sailing for France in May. Captain McCall was graduated from the University of Pennsylvania in 1909 and from its law school in 1913. He was prominent in the athletic affairs of that institution, and for two seasons was a member of the football team and also of the varsity baseball nine. He was also a member of the Mask and Wig Club, and as an undergraduate took a prominent part in several of the annual productions. Besides his parents he is survived by a sister, Miss Lenore McCall, and a brother, Joseph B. McCall, Jr., at the Officers' Training Camp at Camp Zachary Taylor, Louisville, Ky.

LIEUT. WARREN HARRIES, youngest son of General George H. Harries, president of the Louisville Gas & Electric Company and vice-president of H. M. Byllesby & Company, according to a Paris dispatch, was killed in an automobile accident on July 25 in a provincial French city, where he was on duty. General Harries is at present serving with the American army in France.

Personal

James B. Olson Joins Okonite Company—C. A. Graves to Inspect Power Plants—C. H. Hickle Resigns—Changes

ARTHUR J. WAGNER, who for the past eight years has been connected with the electric generating department of the Rochester Gas & Electric Company, has resigned to accept a position with the Taylor Instrument Companies.

SAMUEL S. AMDURSKY, of the engineering department of the Rochester Railway & Light Company, Rochester, N. Y., has gone to Washington, D. C., where he will join the Department of Mechanical Research, Bureau of Mines Experiment Station.

JAMES B. OLSON, general sales manager for the Habirshaw Electric Cable Company, has joined the staff of the Okonite Company of New York City, and will be active hereafter in the sales organization of that well known insulated wire and cable manufacturing company. Mr. Olson's headquarters will be at the New York office of the company, 501 Fifth avenue. He first

James B. Olson.

entered this field as a member of the sales organization of the New York Insulated Wire Company, and later accepted a similar position with the Habirshaw Wire Company, whom he served as sales manager for 18 years. In 1916, when the Habirshaw Wire Company was consolidated with the Electric Cable Company and the Waterbury Company under the name Habirshaw Electric Cable Company, New York City, Mr. Olson was appointed general sales manager, remaining in that capacity until his recent resignation.

C. A. GRAVES, of New York, formerly head of the Graves Engineering Company, has been appointed assistant administrative engineer to inspect power plants and manufacturing concerns in New York. The plants of the Halcomb Steel Company and O. M. Edwards Company, Syracuse, N. Y., have already been inspected and it is expected they will, by making a few improvements, effect a saving of 10 per cent in their coal consumption next winter.

ALBERT KERNS, for a number of years engineer at the electric plant at Millerstown, Pa., has resigned, to become associated with the Pennsylvania Railroad Company, Harrisburg.

R. B. SHEPARD, recently engineer at the Schenectady (N. Y.) office of the Underwriters' Laboratories, has been transferred to the New York testing station as assistant electrical engineer.

E. P. SLACK, formerly assistant electrical engineer at the New York testing station of the Underwriters' Laboratories, is now in charge of general inspection work of that station.

F. H. RICKEMAN, for several years connected with the Interstate Light & Power Company (Northern States Power Company), Galena, Illinois, has been appointed general manager of the company, succeeding W. R. Miller, resigned.

JOHN J. O'BRIEN, vice-president and treasurer of H. M. Byllesby & Company, Chicago, has been appointed a member of the Capital Issues Committee for the seventh Federal Reserve District.

SAMUEL H. ORDWAY, of New York, has been appointed a member of the Public Service Commission for the First District, succeeding Oscar S. Straus, resigned. Mr. Straus's resignation also created a vacancy in the office of chairman of the commission, and Governor Whitman has appointed Charles Bulkley Hubbell, a present member, to succeed in this office.

W. H. HARLAND was recently appointed senior electrical engineer of the eastern district, Bureau of Valuation of the Interstate Commerce Commission, succeeding Milan V. Ayers, who resigned to accept an appointment as major in the National Army. Mr. Harland will be in immediate charge of the electrical, signal and telephone and telegraph branches of the eastern district.

C. M. HICKLE, formerly with the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has resigned to accept the position of sales manager with the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio. Mr. Hickle's past experience well qualifies him to handle the work connected with the sale and installation of automatic reclosing circuit breakers as adapted to various industries.

FREDERICK GOLDING, after serving the New South Wales state telegraph service in various capacities for 37 years, has been appointed chief electrical engineer of the Australian postmaster general's department, succeeding the late John Hesketh. Mr. Golding in his new position becomes chief technical official of the commonwealth's postal telegraph and telephone service, and will be directly responsible for and supervise the continent's lines of communication.

W. L. RAY, JR., formerly connected with the Prest-O-Lite Battery Company at Patterson and Ingalls, Ala., has become associated with the Willard Auto Battery Company.

JOHN P. TOPPING has just completed his twentieth anniversary of service with the Bryant Electric Company of Bridgeport, Conn., and is one of the pioneer western representatives of the eastern manufacturers. He was recently appointed assistant western manager of the Bryant Company with headquarters at 323 West Jackson Boulevard, Chicago, Ill. Mr. Topping was born February 1, 1875, in Alton, Ill., and was first engaged in the wholesale hardware and iron business. In 1891 he went to Chicago, and prior to that time and during the World's Fair was employed by the Ansonia Electric Company. After severing his connection with that company, he became engaged in the contracting

John P. Topping.

business, and was employed in the construction department of the Northwestern Electric Light & Power Company of Chicago until 1898 when he entered the service of the Bryant Electric Company.

Obituary.

GENERAL ANDREW B. AMBLER, formerly treasurer of the Southern New England Telephone Company, died on July 28, at his home, New Haven, Conn., aged 84 years.

ABBOT S. COOKE, of Pittsburgh, Pa., president of the Cooke-Wilson Electrical Supply Company, died on July 25 at his home, 209 Lytton Avenue, aged 59 years.

GEORGE G. CALDWELL, for a number of years construction engineer for H. M. Byllesby & Company, died of heart trouble July 27 at Ottumwa, Iowa, where he was engaged on special construction work for the Ottumwa Railway & Light Company. He is survived by his wife, one daughter and two sons, one of whom is in the United States Navy.

Financial News

Utility Corporation Plan Abandoned.

The proposed plan for the organization of a $100,000,000 corporation for the purpose of financing public utility and other companies has been abandoned by Wall street bankers following the receipt of advices that Attorney General Gregory had handed down an opinion in which it was declared that the 10 per cent limitation provided for in the War Finance Corporation would apply to the projected concern. Under this ruling the maximum amount which the War Finance Corporation could lend to the proposed company would be $50,000,000, which amount was considered too small to make the project worth while. The present prospect is that public utilities must rely entirely on what little assistance may be obtained from the War Finance Corporation and what money may be obtained in the general market by bidding 10 to 15 per cent for short accommodations and equally severe rates for long term loans. The only compensating feature of the ruling is the possibility that the seriousness of the situation created will be sufficient to cause state and municipal rate making bodies to grant immediate rate increases to needy companies and perhaps to induce the President to exercise his power of regulation over utilities as a whole.

It is apparent that the systematic and concerted efforts on the part of the national public utilities committee to public service commissions and kindred bodies with a view to improving their credit situation through rate increases have been productive of some results. It is reported that between January 1 and July 20 between 600 and 700 increases and relief in other forms have been granted in many cases.

In spite of the fact that plans for the formation of a utility corporation have been abandoned, the committee of New York bankers, headed by James N. Wallace, president of the Central Union Trust Company, will now endeavor to devise other means by which the urgent financial requirements of publicity utility corporations may be met. One of the plans suggested is that instead of forming one corporation with a capitalization of $100,000,000 that there be organized five concerns of $20,000,000 capital each, in which case the maximum advances which could be available from the $500,000,000 War Finance Corporation would be $50,000,000 each, or $250,000,000 in the aggregate. Should such a step be taken, it is likely that the corporations would be distributed sectionally, each with an independent management. It is recognized that if the management were the same the establishment of five corporations in place of one would be a mere subterfuge and not acceptable to either the banks or to the Government.

Chicago Telephone to Offer Stock.

The Chicago Telephone Company will issue $4,000,000 adidtional capital stock for the purpose of financing this year's program of extensions and improvements. The new stock will be offered to the stockholders of the company. Nearly all of the stock is owned by the American Telephone & Telegraph Company. The amount to be raised by the sale of the new stock is expected to be more than enough to pay for the betterments planned for the company in 1918.

United Light Company's New Note Issue.

Bonbright & Company, Inc., are offering at 96 and interest, to yield about 8 per cent, a new issue of $1,250,000 United Light & Railways Company 7 per cent bond secured gold notes, series B, dated April 1, 1918, due April 1, 1923. The notes are to reimburse the company for extensions and improvements to its property. They are a direct obligation of the company, secured by 5 per cent bonds due in 1932 in a principal amount of 133⅓ per cent of the par value of the notes outstanding.

Lafayette Company to Issue Stock.

The Indiana Public Service Commission has authorized the Lafayette Telephone Company to issue $70,000 in capital stock to pay for exchange property of the Central Union Telephone Company, recently authorized by the commission to be merged with the Lafayette company's holdings at $55,000. The remainder of the authorization is to be used for defraying other capital account expenses.

Marconi Companies' Profits.

Marconi's Wireless Telegraph Company, Limited, in a report issued in London in July showed net profit of $1,919,177 for the year 1917. Dividends of 20 per cent on the ordinary shares and 17 per cent on the preferred shares are being paid and $500,000 put to general reserve, making it $5,500,000. There is carried forward to next account $1,884,520, as against $1,900,535 brought in from 1916. What remuneration or compensation the company will receive from the Government for the use of its high power stations and for services rendered during the whole period of the war is still unsettled, as is also the amount payable by the postoffice in respect of their repudiation of the contract for the imperial chain of stations. The Marconi Marine Company has paid 15 per cent dividend; the French Company (La Compagnie Francaise Maritime et Coloniale de Télégraphie Sans Fil) 20 per cent on its ordinary shares and 281.25 francs on its founders' shares; the Amalgamated Wireless (Australia) 5 per cent; and the American Marconi Company 5 per cent, for 1917. The Russian Company (Société Russe de Télégraphes et Téléphones Sans Fil) declared no dividend for 1917, but "there is reason to believe that the position of the company, considering the circumstances, is not unsatisfactory."

Earnings.

ARIZONA POWER COMPANY.

The earnings of this company for March are reported as $18,958, gross, or 51.2 per cent over those of March, 1917. Operating expenses and taxes left a net income of $610, or 2.3 per cent.

NORTHERN OHIO ELECTRIC.

Gross earnings of the Northern Ohio Electric Corporation for June were $593,513, increased 12.90 per cent; operation expenses, $384,184, increased 14.84 per cent; net profits, after fixed charges, $64,777, decreased 2.69 per cent. For 12 months ended June 30, gross earnings, $6,822,189, increased 16.13 per cent; operating expenses, $4,350,747, increased 28.50 per cent; net profits, after fixed charges, decreased 16.52 per cent, and balance available for replacements and dividends on common stock, $492,510, decreased 25.52 per cent. The balance is equivalent to $6.57 per share on 75,000 shares of common stock.

SOUTHERN CANADA POWER.

The following are the gross and net earnings of the Southern Canada Power Company, Limited, and its subsidiaries for the month of June, and for the 9 months ending June 30, as compared with the same period of last year:

June—	1918.	1917.
Gross	$ 39,949.40	$ 33,340.87
Operating expenses and purchased power	22,750.01	19,319.18
Net earnings	$ 17,199.39	$ 14,021.69

9 months ending June 30, 1918—	1918.	1917.
Gross	$353,815.25	$290,424.72
Operating expenses and purchased power	196,352.38	155,290.70
Net earnings	$157,462.87	$135,134.02

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. July 30.	Bid. Aug. 6.
Adirondock Electric Power of Glens Falls, Common	6	15	15
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	81	81
American Gas & Electric of New York, preferred	6	37½	37
American Light & Traction of New York, common	..	186	183
American Light & Traction of New York, preferred	6	93	90
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	66	66
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	91¼	92
American Water Works & Elec. of New York, common	..	4½	4½
American Water Works & Elec. of New York, particip	7	12	11
American Water Works & Elec. of New York, first preferred	..	55	55
Appalachian Power, common	..	3	3
Appalachian Fower, preferred	7	20	20
Cities Service of New York, common	+extra	207	207
Cities Service of New York, preferred	6	74¼	74
Commonwealth Edison of Chicago	8	100	100
Comm. Power, Railway & Light of Jackson, common	..	21	22½
Comm. Power, Railway & Light of Jackson, preferred	6	41½	41
Federal Light & Traction of New York, common	..	7½	7½
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	10	10
Middle West Utilities of Chicago, preferred	6	37	37
Northern States Power of Chicago, common	..	42	42
Northern States Power of Chicago, preferred	ex.div.7	79	79
Pacific Gas & Electric of San Francisco, common	..	34½	34
Pacific Gas & Electric of San Francisco, preferred	6	80½	79
Public Service of Northern Illinois, Chicago, common	7	72	72
Public Service of Northern Illinois, Chicago, preferred	6	82	82
Republic Railway & Light of Youngstown, common	4	20½	20
Republic Railway & Light of Youngstown, preferred	6	59	59¼
Standard Gas & Electric of Chicago, common	..	4	4
Standard Gas & Electric of Chicago, preferred	6	20	21½
Tennessee Railway, Light & Power of Chattanooga, common	..	3	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	14	14
United Light & Railways of Grand Rapids, common	4	30	30
United Light & Railways of Grand Rapids, preferred	6	62	60½
Western Power of San Francisco, common	..	13½	13
Western Power of San Francisco, preferred	6	50½	50
Western Union Telegraph of New York	extra	80	79
Industrials—			
Electric Storage of Philadelphia, common	4	50	50
General Electric of Schenectady	8	145	144
Westinghouse Electric & Mfg. of Pittsburgh, common	7	42	42
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	58	58

*Last sale.